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FCC moves worry users of Tariff 12

By Ellen Messmer
and Bob Wallace
Network World Staff

WASHINGTON, D.C. — The FCC has in the past two weeks rejected changes to eight AT&T Tariff 12 contracts, raising fears among users that they will be hamstrung by their inability to modify the custom networks.

Last week, the Federal Communications Commission nixed modifications for Tariff 12 options believed to be used by James River Corp. of Virginia, Primerica Corp. and United Technologies Corp.

A week earlier, the FCC rejected changes to packages believed to be used by Citibank, N.A., CSX Corp., Litton Industries, Inc., Metropolitan Life Insurance Co. and PaineWebber, Inc. Decisions on six other options, including those reportedly used by Airborne Express and Allied-Signal, Inc., are still pending.

The FCC rejected changes, such as adding and dropping data and voice services or modifying pricing structures — alterations that were routinely approved by the agency in the past.

The decision has spurred concern among Tariff 12 users — which include some of the largest

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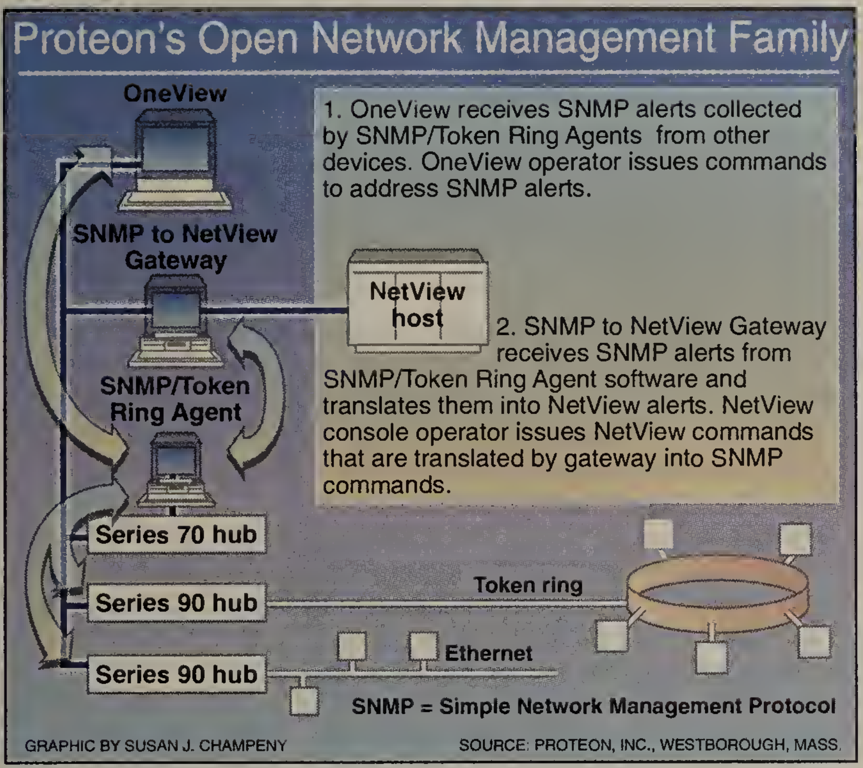
Proteon's Open Network Management Family



1. OneView receives SNMP alerts collected by SNMP/Token Ring Agents from other devices. OneView operator issues commands to address SNMP alerts.

2. SNMP to NetView Gateway receives SNMP alerts from SNMP/Token Ring Agent software and translates them into NetView alerts. NetView console operator issues NetView commands that are translated by gateway into SNMP commands.

SNMP = Simple Network Management Protocol

GRAPHIC BY SUSAN J. CHAMPENY SOURCE: PROTEON, INC., WESTBOROUGH, MASS.

Proteon launches line of SNMP tools, new LAN hub

By Bob Brown
Senior Editor

WESTBOROUGH, Mass. — Proteon, Inc. last week unveiled a series of Simple Network Management Protocol (SNMP)-based net management software products and its first intelligent wiring hub.

Proteon's new Open Network Management Family, which will be available in phased releases starting in February, includes an SNMP-based management system designed to oversee Proteon's product line and other vendors' SNMP-based gear, SNMP agent software for its Series 70 and the new Series 90 hub, as well as an SNMP gateway to IBM's NetView and Systems Center, Inc.'s Net/Master.

The Series 90 Intelligent Network Concentrator, which is available now, is designed to support Ethernet and token-ring networks, a routing module and redundant power supplies ("Proteon to air high-end wiring hub," *NW,* Dec. 23, 1991). The hub costs $123 per token-ring port, compared with more than $200 per port for most hubs.

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Systems Center maps new Net/Master plan

Product to get graphical user interface, support OSF's Distributed Management Environment.

By Paul Desmond
Senior Editor

RESTON, Va. — Systems Center, Inc. is expected to announce in January plans to make Net/Master an open management system based on the Open Software Foundation, Inc.'s Distributed Management Environment (DME) as well as unveil a graphical user interface (GUI) for the product.

The company, based here, will introduce the GUI at ComNet in Washington, D.C. Net/Master is an alternative to IBM's NetView for network and systems management in Systems Network Architecture environments.

As part of its strategy to enable Net/Master to interoperate with other management systems in a standards-based, peer-to-peer environment, Systems Center will announce plans to join OSF and support DME, said Chris Christiansen, an analyst with the META Group, a consultancy in Westport, Conn.

DME support, which is expected to be announced at the Uniforum Conference and Trade Show in San Francisco during the week of Jan. 20, complements the firm's plan to move away from the mainframe as the sole platform for management applications.

The company is already moving in that direction by working with vendors such as AT&T and Digital Equipment Corp. to forge

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PHOTO ©FEB. 1991 MARK A. ANDERSEN

A Patriot Missile knocks out an incoming Scud during Gulf War.

Paperfree factory gets Patriot flying

By Wayne Eckerson
Senior Editor

ANDOVER, Mass. — Raytheon Co., manufacturer of the famed Patriot Missile used in the Gulf War, says the surface-to-air defense system got off the ground with the help of a network-based paperless manufacturing system the company deployed in its main plant here.

When Iraqi forces invaded Kuwait in August 1990, Raytheon's Missile Systems Division (MSD) had just finished redesigning the Patriot Missile to enable it to intercept incoming tactical ballistic missiles in addition to aircraft. At that time, MSD had only three of the redesigned missiles on hand.

But with a rush order from the U.S. Army, the Andover plant accelerated production and delivered more than 300 missiles by the end of November, four months ahead of its pre-August

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NETLINE

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NEWSPAPER

FEATURE

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Beware of hidden factors in buying 16M token ring

By Mike Hurwicz
Special to Network World

Announced by IBM in November 1988, the 16M bit/sec Token-Ring Network was expected to quickly become a popular product for interconnecting 4M bit/sec token rings. But for more than half of its three-year life span, high-speed token rings were held back by technical problems such as persistent jitter.

Those problems have been resolved, and many users are now successfully running token rings at 16M bit/sec, though not necessarily as backbones.

While some users are deploying the local-area networks in that manner, others are simply using them to support desktop devices that can benefit from the higher speed.

Still other users are installing token-ring equipment that can run either at 4M or 16M bit/

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Multimedia Mac demo to headline MacWorld Expo

Eleven vendors team to show products enabling Macs to support voice, data and video services.

By Bob Wallace
Senior Editor

SAN FRANCISCO — Several leading network vendors will stage an elaborate demonstration at MacWorld Expo/San Francisco next week that is designed to showcase Apple Computer, Inc.'s Macintosh as a multimedia workstation.

Eleven vendors, known as the Proto/CALL Group, will demonstrate commercially available products and services that enable the Macintosh to support voice, data and video communications. Some of those members include: Ascend Communications, Inc., International Transware, Northern Telecom, Inc., Pacific Bell and PictureTel Corp.

"This project has been six months in the making and is designed to show users that the Macintosh can be made into a multimedia workstation," said Paul Weigand, event coordinator for the Proto/CALL Group and director of wide-area networking business development at International Transware, a router vendor based in Mountain View, Calif. "All the puzzle pieces are available and can finally be put together."

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Local-loop mart tops list of areas to watch in 1992

Advisory panel bearish on standards, economy.

By Joanne Cummings
Staff Writer

Open competition in the local loop, a greater focus on public network reliability and the lack of frame relay network management tools are some of the key issues members of *Network World's* User Advisory Panel say will be resolved in 1992.

The panel expressed hope but less optimism about the resolution of several other issues, including greater progress toward international standards and global competition as well as an economic recovery in the U.S.

One of the more significant changes expected by the User Advisory Panel, which includes representatives from large U.S. companies, government agencies and many large network user groups, involves regulation of the local exchange.

"I would say that the states, which would be led by New York and possibly Illinois, will take some giant strides in public policy that will allow for greater competition in the local exchange," said William Pomeroy, director of telecommunications public policy for the International Communications Association. "New York has already set forth some very challenging ideas and rules [in terms of collocation], and I think

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HP set to unveil its first token-ring interface cards

By Caryn Gillooly
Senior Editor

PALO ALTO, Calif. — Hewlett-Packard Co. is expected to announce today its first token-ring interfaces and drivers for the firm's Reduced Instruction Set Computer (RISC)-based workstations and minicomputers.

The products will enable HP customers to connect their HP machines directly to token-ring backbones. Before, HP only provided direct connections to Ethernet local-area networks. The company has also announced plans to support Fiber Distributed Data Interface nets.

"Before this, our systems did not support native token ring; customers had to be connected to a bridge that supported both Ethernet and token ring," said Debra Johnson, product marketing manager at HP, based here. "But customers said the bottleneck of the bridge and having to support the extra box was unacceptable. They wanted native token-ring support."

HP will offer token-ring cards and drivers for three machines: the HP Apollo 9000 Series 700 workstation as well as the HP 9000 Series 800 and HP 3000

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Briefs

AT&T to intro videophone. AT&T is expected to announce today a new videophone that delivers both audio and video signals over analog, dial-up telephone lines using modems running at 19.2K bit/sec, according to analysts briefed by the carrier. The videophone will use compression technology AT&T acquired from videoconference equipment maker Compression Labs, Inc. of San Jose, Calif. It will sell for $1,500. The device contains a camera and a 3.3-in. square video screen and will deliver full-motion video, although the image will be somewhat shaky. An AT&T spokesman declined to comment on the reports except to say the company will make an announcement related to videotelephony today.

Virus busters join hands. The Antivirus Methods Congress, a newly formed organization to combat computer viruses, was announced last week with the goal of bringing users, vendors and researchers together to tackle virus attacks on networks in the private and government sectors.

Dick Lefkon, associate professor at New York University and chairman of the new group, said the organization already has 50 members, including representatives from Martin Marietta Corp., the insurance industry, the state of Arizona's legal department, Northern Telecom, Inc. and universities in Hamburg, Germany, and Iceland.

FAA awards contract for control net. The Federal Aviation Administration (FAA) last week awarded Harris Corp. a $1.6 billion contract to modernize the nation's aging air traffic control network. Under the 15-year Voice Switching and Control System contract, Harris will supply new switching systems and electronic touch-screen displays that FAA air traffic controllers will use in ground-to-ground and air-to-ground communications. AT&T, which came up short in the bidding, indicated that it will decide whether to protest the decision following a debriefing by the FAA.

New satellite service commences. Columbia Communications Corp. last week said the Federal Communications Commission gave it permission to begin offering international satellite services via 24 36-MHz C-band transponders that the company owns on two National Aeronautics and Space Administration satellites.

As a result, Columbia is now able to support international private networks between the U.S. and the U.K., the only two countries where it has permission to operate. Columbia was the first private satellite company authorized by the FCC to serve the Pacific Rim and is now the second (after Alpha Lyracom Space Communications, Inc.) authorized to serve the Atlantic region. Columbia is seeking permission to provide service in most countries in these areas.

United Telecom finishes buy. United Telecommunications, Inc. last week announced that it will acquire GTE Corp.'s 19.9% interest in US Sprint Communications Co., giving United Telecom complete ownership of the long-haul carrier. United Telecom will pay GTE $530 million for the remaining stake of US Sprint. It will pay $250 million in cash on Jan. 30, the expected closing date, with the balance to be paid in cash on July 1. US Sprint, formed by United Telecom and GTE in 1986, has been under the day-to-day control of United Telecom since 1988. GTE sold 30.1% of its stake in US Sprint to United Telecom during 1989.

Obuchowski departs NTIA. Janice Obuchowski, assistant secretary of commerce for communications and information and administrator at the National Telecommunications and Information Administration (NTIA), announced that she will leave NTIA on Jan. 31 to set up a telecommunications research and consulting firm. Thomas Sugrue, NTIA's deputy assistant secretary, will become acting administrator until a successor is named.

Call for GroupWare papers issued. The Conference Group announced that it is accepting papers for presentation at GroupWare '92, a conference focusing on commercial groupware scheduled for Aug. 3-5 in San Jose, Calif. The conference is cosponsored by Lotus Development Corp. and SRI International. Papers must be submitted by March 15 along with a 50-word speaker biography. Send abstracts to David Coleman, conference chairman of GroupWare '92, The Conference Group, 9875 111th Place, Scottsdale, Ariz. 85259.

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Don't Let Your Token Ring Mau Cau Be Blue.

Take a look at our Token Ring MAU features. Nothing to be blue about. In fact, you'll find that Optical Data Systems has features no other Token Ring manufacturer offers. Features that have set standards for Token Ring networking for today and the future.

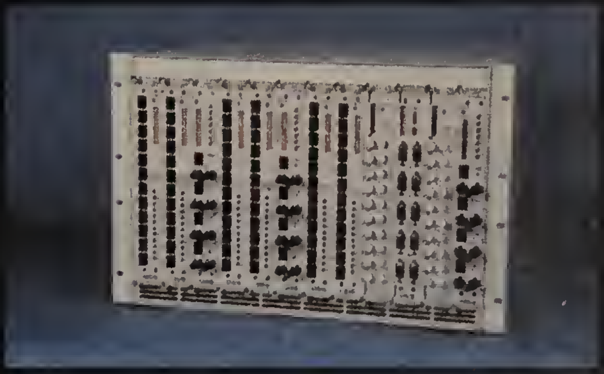
For instance, our MAU was the first MAU with LAN Manager reporting capabilities. And the leadership continues with products that support:

- Simultaneous SNMP Token Ring network management and LAN Manager reporting capabilities.
- 16 Mb/s over unshielded twisted pair, active user ports that provide exceptional cabling distances between user and MAU.

Plus, you get fiber optic ring-in/ring-out ports at no additional cost with all ODS Token Ring MAUs. Another reason it's more than a match for a blue CAU. And another reason, ODS has shipped more Token Ring intelligent hubs than any other manufacturer. Which is why some of our competitors are looking a little green.

PRODUCT COMPARISONS

	ODS	IBM 8230
Lan Manager REPORTING Capabilities	YES	YES
SNMP Network Management	YES	no
Available Internal Token Ring Bridge	YES	no
Out-Of-Band Network Management	YES	no
Fiber Optic Lobe Ports	YES	no
MAU Bypass Capabilities	YES	no
Ring/Star Topology Capabilities	YES	no
Multiple Networks In One Chassis	YES	no
Token Ring & Ethernet In The Same Chassis	YES	no
Maximum Ports Per Unit	192	80
Fiber Optic Ring-In/Ring-Out	YES	optional
Auto Loop Capabilities	YES	YES



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SynOptics readying router module, token-ring hubs

Also scheduled to make net mgmt. announcement.

By Bob Brown
Senior Editor

SANTA CLARA, Calif. — SynOptics Communications, Inc. is readying a series of token-ring work group hubs and a new router module for its existing hub that is designed in conjunction with Cisco Systems, Inc., *Network World* has learned.

The company is also scheduling a press conference on Jan. 14 in Boston to announce a new suite of network management products. However, SynOptics declined to comment on its plans.

SynOptics' new Model 2700 token-ring work group concentrators will support 16 ports and a variety of media, including shielded and unshielded twisted-pair wire, according to Ed Barrett, president of Hi-Tech Connections, Inc., a reseller and systems integrator in Reading, Pa.

The products will also incorporate the 16M bit/sec token ring-over-unshielded twisted-pair wire technology that SynOptics developed in conjunction with IBM.

The work group hubs will be available both as managed and unmanaged devices, with the unmanaged devices being less expensive, Barrett said. Users will be able to tie unmanaged devices into managed devices to provide control over those hubs.

The token-ring hubs will complement SynOptics' System 3000 intelligent wiring hub, which supports Ethernets as well as token-ring and Fiber Distributed Data Interface nets via plug-in media modules. They also complement SynOptics' 10Base-T and FDDI work group concentrators.

Information about cost was not available at press time, but the hubs are expected to be priced aggressively.

"SynOptics had missed some opportunities in the mid-market, where a lot of times customers are departmentalized and have single protocol requirements," Barrett said. "Lowering the prices of its 10Base-T hubs has helped here, and I think the 2700 will address that same mid-market from the token-ring side."

Although sources said the hub annoucement would be made this quarter, a SynOptics spokesperson the announcements are a ways off.

The new System 3000 router module — developed by SynOptics in conjunction with Cisco — is designed to route data between Ethernet, token-ring and FDDI nets, Barrett said. Currently, SynOptics offers router modules based on Cisco technology that provide local and remote Ethernet routing, he said.

Not many details were available about the new network management applications. The applications, which will run on top of SynOptics' existing LattisNet Network Manager for Unix and LattisNet Network Manager for DOS, are expected to support automatic trouble ticketing, forecasting, accounting and trend/analysis, according to Barrett.

"In the past, a lot of people would buy the network management software but never really do any 'baselining' to find out where they started," Barrett said. "You can't compare your situation now to what it was last week." These tools are designed to help overcome that problem, he added.

FCC allows RBHC to offer ONA despite rate questions

By Anita Taff
Washington Bureau Chief

WASHINGTON, D.C. — The FCC last week cleared the way for users and carriers to begin purchasing Open Network Architecture (ONA) services from Ameritech, but the agency left unresolved questions about whether customers will be overcharged for the services.

The Federal Communications Commission allowed Ameritech's ONA tariff to take effect, making it the first regional Bell holding company to offer ONA services. Among the 30 ONA network features Ameritech is selling are call routing, automatic number identification, traffic data collection and specialized signaling arrangements.

Citing concerns about the prices Ameritech wants to charge for ONA services, the FCC ordered an investigation into the rates. The RBHC can sell services immediately, but if the prices are later found to be too high, the carrier may have to refund users.

ONA is the FCC's plan for allowing the RBHCs to provide enhanced services in exchange for opening their networks. Under ONA, all customers, including rival enhanced service providers, will be able to purchase network capabilities on an unbundled basis.

Today, many service capabilities — such as switching and data collection — may be packaged under a single service tariff.

But potential ONA customers, including members of user groups such as the Ad Hoc Telecommunications Users Committee, were highly critical of the way Ameritech figured its rates. They claim that some services may be priced as much as six times above cost.

Users have also criticized other RBHCs' rates, and the FCC has until early February to decide whether to allow the six other RBHCs' ONA tariffs to take effect.

James Blaszak, counsel for the Ad Hoc Committee, said he was

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Amnet X.25 switch gets frame relay, more ports

By Paul Desmond
Senior Editor

FRAMINGHAM, Mass. — Amnet, Inc. last week announced a frame relay interface for its Nucleus 7000 (N7000) Series packet switches along with new RISC processing capabilities that dramatically increase the performance of the switches and enable them to support double the port capacity.

The company also announced plans to develop a line of so-called access products that will let users attach a variety of devices and networks to high-speed carrier services, such as frame relay or switched data services.

The N7000 Series is a line of software products that let any personal computer with an Industry Standard Architecture (ISA) bus serve as a packet switch.

To boost performance, Amnet unveiled an ISA-bus communications adapter, dubbed the RCA 960, based on the Intel Corp. i80960CA Reduced Instruction Set Computer processor. The RCA 960, which supports both wide-area and local access ports, replaces the Intel 80186-based adapter currently used for the N7000 Series.

The RCA 960 will enable a single N7000 node to support up to 64 ports, twice as many as the current adapter. The price per port will also drop from about $1,000 to $600, Amnet said.

The i960 processor supports throughput between 1,000 and 4K packet/sec for 128-byte packets, depending on the protocol used, said Robert Machlin, Amnet's vice-president of marketing. By contrast, the current adapter supports throughput between 100 and 200 packet/sec.

With the new adapter, N7000 switches will be able to process 128-byte frame relay frames fast enough to fill about three T-1s, Machlin said.

Frame relay support will be delivered via a software upgrade. The switches will support a frame relay data communications equipment interface, enabling them to provide access to a frame relay net from devices such as bridges, routers and frame relay packet assembler/disassemblers. It can also be used to connect to a public frame relay service.

The RCA 960 will also be employed in Amnet's new line of access products. The products will support multiple T-1s, Machlin said, as well as access to switched 56K and 384K bit/sec and T-1 services.

Amnet's access products will support various types of data, including Systems Network Architecture, asynchronous, X.25, Binary Synchronous Communications and frame relay.

The products will eventually support the direct attachment of local-area networks.

Jay Hill, president and chief executive officer of Amnet, based here, would not say when his company plans to formally announce its access products, although he said the first products would be delivered this year.

The RCA 960 will be available in April at a price of $3,900 for a four-port version and $4,850 for the eight-port model. The frame relay software will be available in May at no charge to users on Amnet's software subscription program.

Also last week, Amnet announced it is extending an existing agreement with IBM to include X.25 concentrator products. IBM's X25Net Switch packet switch and X25Net Manager products are both based on Amnet technology. The new agreement is for a low-end packet switch, also based on Amnet technology, that will support a PAD function and act as a feeder node to X25Net Switches, Machlin said.

Amnet also announced it has signed a joint development agreement with Racal-Datacom, Inc.

Richard Abbruscato, vice-president of Racal-Datacom's network systems division, said his company will use Amnet's RISC and frame relay technology in a device that concentrates packet-oriented traffic for a public frame relay service or to build a private frame relay net.

HP set to unveil interface cards

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Model 900 minicomputers.

The products for the Series 700 workstation — which use an Extended Industry Standard Architecture (EISA) bus — will be acquired from Madge Networks, Inc. through an OEM and development agreement, also to be announced today. HP will resell Madge Networks' 32-bit Smart 16/4 EISA Ringnode as the net interface card for the Series 700.

Although other vendors offer token-ring cards for HP machines based on the EISA bus, none offered HP drivers. For the other two models, which use an HP proprietary bus, the company will release cards and drivers it developed internally.

All three cards will support both 4M and 16M bit/sec transmission over shielded twisted-pair wire but will support only 4M bit/sec over unshielded twisted pair. An HP spokesman said the company will not announce support for 16M bit/sec over unshielded twisted pair until a standard has been established.

HP said the reason it added token-ring support was to attract more customers from large financial and commercial businesses that currently have IBM Token-Ring environments.

Analysts said that, although HP is filling an obvious hole in its product line, the company may not attract the type of customer it hopes to entice.

"This will get [HP] minis on token-ring LANs, which is a good thing, but it's still limited," said Joe Gottlieb, an analyst at the META Group, based in Westport, Conn. The company still lacks support for 16M bit/sec over unshielded twisted pair, he added.

Janet Hyland, director of network strategy research at Forrester Research, Inc. in Cambridge, Mass., said the announcement will appeal most to HP's existing customers that need to connect workstations or minicomputers to other token-ring nets. However, she does not see HP attracting new business from Fortune 500 companies that it did not already have as customers.

"From our research, we find that the token-ring buyer is an IBM buyer," Hyland said. "Token-ring buyers won't be open to buying workstations from HP if they never have before."

According to Gottlieb, although this announcement is significant, HP also needs to provide token-ring support in its hub products, where customers probably need it most.

HP would not say whether it is developing a "TokenTwist" product to go with its current EtherTwist hub, although Gottlieb predicted that HP would release some type of token-ring support for its hub by the end of 1992.

Token-ring cards for the HP 9000 Series 800, to be available by the end of January, are priced from $1,295 to $2,895. The Series 700 workstations cards, to be available in March, cost $1,595. Pricing for the HP 3000 Model 900 token-ring cards, expected in the first half of 1992, has not yet been set.

FCC worries Tariff 12 users

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U.S. companies — that their long-term custom net deals will not evolve as their needs change.

"It's a really bad dream for major users," said Henry Levine, an attorney based here who has helped several users negotiate Tariff 12 deals.

For its part, AT&T has vowed to find a way to serve customer interests.

Users also got some hope last week that the FCC might waver. The agency said it would give AT&T a chance to defend Tariff 12 changes, giving the carrier until Jan. 7 to present arguments on the rejected modifications. Other parties have until Jan. 17 to file comments.

The full impact of the rulings began to hit home recently as users returned from the holidays.

"We don't know why they're rejecting it at this point," said a spokeswoman for one Tariff 12 user who requested anonymity. The FCC rejected the company's request to add digital data services to its Tariff 12 package.

The spokeswoman said the FCC's actions have left personnel at the company wondering what course to take.

According to Ben Styers, team leader with USAir, Inc.'s Winston-Salem, N.C., office, "If the FCC continues to reject changes, it'd make life pretty tough for us. It's very likely we will want to make changes to our network over time." USAir holds Option 26.

The FCC's decision to reject Tariff 12 changes stems from an August ruling in which the agency said AT&T should not be allowed to bundle 800 services in Tariff 12 packages until 800-number portability is feasible.

The agency has said that allowing major changes to existing Tariff 12 deals that include 800 service, which is virtually all Tariff 12s, would be inconsistent with its August ruling.

After delaying decisions on proposed Tariff 12 changes, the FCC in December 1991 rejected what it viewed as major changes to two options. The FCC did, however, approve changes to Option 15 for MasterCard International, Inc. and Honeywell, Inc., saying the changes were insignificant and "ministerial."

Users have begun to mull the next step to take in coping with the situation, Levine said. "We don't know what we're going to do. The FCC is disallowing many more than users expected."

Styers and others say they will study the revisions that have been approved as well as those that the FCC has rejected before forming a plan of action.

"It's the first step," he said. "I don't know where we'll go from there."

Since the rejections came from the FCC's Common Carrier Bureau, users may decide to ask the full commission for reconsideration, Levine said.

He said users may even be forced to seek the FCC's OK to bail out of the deals if no satisfactory resolution of the impasse is found. Most Tariff 12 options carry penalty charges for early termination of the contract.

Richard Harper, an internal network consultant at E.I. du Pont de Nemours & Co., which holds Option 29, said his company is not seeking changes but the decisions are still cause for concern.

Harper said it might be easier to file a new option that does not include 800 service than to ask the FCC to approve changes to an existing option.

"I think this is a path many other users may follow if they need to make [substantial] changes," he said.

Russell Bowen, a network manager with Aetna Life and Casualty, Inc. in Hartford, Conn., said his company will likely want to bring new services under its arrangement before the contract expires in 1994.

"We're looking at the possibility of adding frame relay service to our option, but we don't want to have an attempt to do so blocked by the FCC," Bowen said. "That would make life difficult." Aetna holds Option 22. ◘

Local-loop mart tops list in 1992

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others will follow."

Stanley Welland, manager of corporate telecommunications for General Electric Co., agreed that the local loop is the area to watch in '92. "I expect to see greater deregulation of the local exchange carriers and the RBHCs," he said. "The implications of that would hopefully be lower access costs and greater flexibility on the part of the RBHCs to compete with the interexchange companies and provide services like inter-LATA [Switched Multimegabit Data Service]."

Another area network managers should watch is the Federal Communications Commission's push toward 800-number portability, according to Welland. "Network managers should focus on how successful the FCC is working with the local exchange carriers to make 800 portability possible," he said. "That's going to be a major issue because it is an opportunity for network managers to reduce their costs."

Pomeroy is less optimistic about seeing the end to the dispute over whether the RBHCs should be permitted to enter the equipment manufacturing business. "This issue has been going on for so long, you just get discouraged after a while," he said. "That's certainly on my wish list for 1992 — to put that to bed."

Another area the panel termed crucial in 1992 is public network reliability. "It's a split as to whether this is significant or political, but I think the establishment of the FCC Telecommunications Reliability Council will be something to watch in the coming year," Pomeroy said.

The council, to be made up of carriers, users, equipment suppliers and regulators, has been charged with addressing network reliability in the wake of several outages last year (see "A look back at the news of '91," this page).

"I think that you'll see activity right after the first of the year in terms of naming people to that council," he said. "They're going to have a shaky start, but I think they can make a contribution in 1992."

In the long-haul arena, the panel sees the year ushering in the first significant increases in long-distance calling charges since divestiture. "We're going to start to see those rates begin to increase significantly in 1992," Welland says. "People that have bulk service agreements or contracts with carriers will be protected over the near term, but I think as those contracts expire, network managers will be hit with higher costs than they currently anticipate."

Another happening to watch for in the coming year is the emergence of tools for monitoring and managing frame relay networks. "I think good progress will be made on this in '92," said Phillip Evans, telecommunications director at FMC Corp. "It's just too practical a service not to see some advancement."

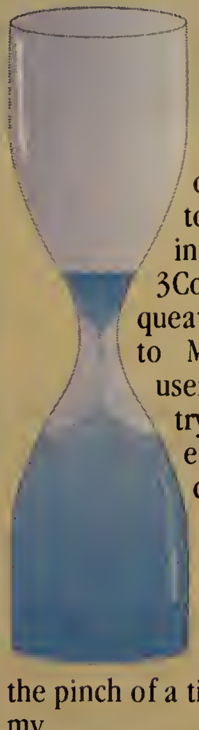
Evans also predicted more widespread use of frame relay. "We'll see local-area networks on various continents connected to one another via fiber optic-based frame relay and cell relay wide-area networks," he said.

The panelists expressed less optimism about the progress toward open standards and global competition. "I'd love to see standards take the fast track that we've seen frame relay take," Evans said. "But I don't anticipate this happening for standards in 1992; there are just too many private agendas."

Welland concurred. "I'd like to see true global standards and competition evolve in 1992," he said. "We're on the path to privatization and deregulation around the world, but it's not happening fast enough. I would like to see it accelerate in 1992."

On a bleak note, the panelists hoped, but didn't expect to see, an economic turnaround in the coming year. "I'd love to see a nice economic recovery in '92, but I think it would be a little utopian of me to expect to really see it," Evans said. ◘

A look back at the news of '91



JANUARY: AT&T experiences the first in a series of net outages, this due to a fiber cable cut in New Jersey; 3Com Corp. bequeaths LAN Manager to Microsoft Corp.; users in some industry sectors experience network congestion as a result of Desert Storm; salary survey finds network managers feeling the pinch of a tightening economy.

FEBRUARY: IBM and Digital Equipment Corp. announce alliances with Novell, Inc.; radio spectrum battle heats up as Federal Communications Commission announces plan to displace microwave users to make room for new wireless technologies.

MARCH: U.K. ends duopoly system and opens telecommunications market to full competition; American Airlines, Inc. prepares to migrate SABRE to Open Systems Interconnection; MCI Communications Corp. plans trial of Switched Multimegabit Data Service with Nynex Corp. and Bell Atlantic Corp.; *Network World* celebrates its fifth anniversary.

APRIL: IBM and AT&T agree to link their respective NetView and Accumaster Integrator products; WilTel becomes the first carrier to offer frame relay service; virus knocks out 3Com's internal network for several hours.

MAY: MCI announces frame relay support; Apple Computer, Inc. releases its System 7.0 operating system; AT&T buys NCR Corp.; FCC allows bypass carriers to collocate transmission equipment in carrier central offices.

JUNE: Survey finds net security, staff shortages and networking Microsoft Windows to be major user issues; Unisys Corp. sells Timeplex, Inc.; IBM adds Ethernet and frame relay support to 3745 controller line.

JULY: Bell Atlantic and Pacific Telesis Group experience outages due to glitches in Common Channel Signaling System 7 software; vendors form alliance to standardize Fiber Distributed Data Interface over unshielded twisted pair; the SQL Access Group unveils a protocol for data sharing between SQL databases.

AUGUST: FCC releases AT&T from price cap regulation and bars it from offering 800 services under Tariff 12; Microsoft offers LAN Manager with NetView links and Windows 3.1 support.

SEPTEMBER: Wellfleet Communications, Inc. offers gigabit-speed router; Remedy Corp. unveils generic trouble ticketing application for integrated net management systems; IBM introduces Information Warehouse framework and software for managing local-area network workstations; Open Software Foundation, Inc. announces vendors whose technology will form the basis of the group's Distributed Management Environment; AT&T experiences outage from Manhattan power failure; British Telecommunications PLC delivers frame relay service and pricing; Crescendo Communications, Inc. offers FDDI over copper.

OCTOBER: NCR scraps plans for an OSI router; Apple and IBM flesh out plans for integrating the Macintosh into Systems Network Architecture nets; *Network World* test series finds $1 shareware offers the best virus protection.

NOVEMBER: IBM and SynOptics Communications, Inc. propose method for running 16M bit/sec token-ring networks over unshielded twisted-pair wire; AT&T plans frame relay rollout; Texas Instruments, Inc. and Columbia Gas Transmission Corp. are named cowinners of *Network World's* User Excellence awards.

DECEMBER: Lotus Development Corp. to open Notes groupware to support other databases, as well as SNA and X.25 links; Cable & Wireless PLC plans frame relay service; Novell and Unix Systems Laboratories, Inc. blend NetWare with Unix.

— Joanne Cummings

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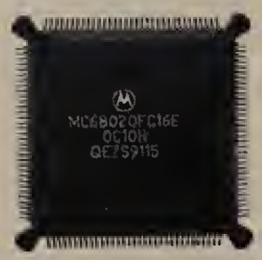

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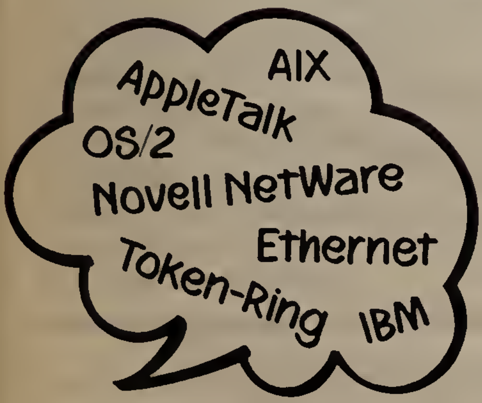

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PRINTERS. PAGES AHEAD

Systems Center maps new Net/Master plan

continued from page 1

links between Net/Master and their minicomputer-based management systems. Systems Center also has or is working on Net/Master versions that run on computers from Fujitsu, Ltd. and Tandem Computers, Inc, respectively.

Michael Matthews, director of strategic marketing at Systems Center, confirmed the company's plan to support DME but declined to provide further details.

"Net/Master will evolve to interoperate in a DME environment and support DME-compliant applications," he said. "The tenets of DME are open protocols, object-oriented data management, an object-based data model and a common user interface. We're working in all those areas."

The DME is a base management platform that provides a common set of services, such as a database and trouble ticketing facility, used by DME-compatible applications. The goal is to let applications written by different vendors for their specific products run on a common platform.

Systems Center plans to evolve Net/Master into a DME-compatible system on which other vendors' applications can run, Christiansen said. That's a long-term project not likely to come to fruition for at least two years.

"For the customer, DME is a 1994 thing," Matthews said. "We'll be in the market substantially sooner than those with peer-to-peer management systems that will evolve to be DME-compliant."

Along the way, Systems Center will deliver DME-like facilities to make the migration easier. For example, the company plans to announce by the middle of 1992 object-oriented data management services and applications, including problem, change, configuration and accounting management tools. Object-oriented application development tools are also on tap. IBM is expected to support DME in the AIX-based management product it plans to announce soon and will use parts of the technology, including its own object-oriented data engine, in NetView. The company has stopped short of saying NetView will become a DME-based system.

IBM is ahead of Systems Center in the GUI department, but probably not for long. Systems Center's GUI will be compatible with the interface specifications of SystemView, which calls for an OS/2-based GUI compatible with IBM's Common User Access.

Net/Master's GUI will support both network monitoring and control, Christiansen said. IBM's NetView GUI supports only monitoring, although IBM has announced plans for control features.

Net/Master will also support both the Simple Network Management Protocol (SNMP) and the Common Management Information Protocol (CMIP). Net/Master already supports SNMP by converting SNMP data to IBM's Network Management Vector Transport format. At ComNet, Systems Center will announce the ability for Net/Master to accept native SNMP alerts, which will improve performance.

CMIP will let Net/Master communicate with other management systems. An early CMIP version lets Net/Master communicate with AT&T's Accumaster Integrator.

All these efforts, as well as moves to port Net/Master to other machines, are aimed at giving users more management platform options.

"That's going to be a big plus for them," said George Sackett, president of ASAP Technologies, Inc., a consultancy in Rutherford, N.J. For example, users could employ a Tandem machine to manage local-area networks linked to a mainframe should the mainframe fail.

Analysts also expect Systems Center to unveil a Unix version of Net/Master. "Customers would love to to run [Net/Master] on some [Reduced Instruction Set Computer]-based, commodity-priced platform, rather than soak up mainframe cycles," said David Passmore, a partner at Ernst & Young, a consultancy in Vienna, Va. ☐

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Proteon launches net mgmt. products

continued from page 1

Although Proteon is late entering the hub market, the company's token-ring expertise will serve as a differentiator, according to Henry Turko, director of Proteon's wire-center product marketing. Most of the leading hub vendors have roots in Ethernet, he said. The new network management products are designed to further differentiate Proteon's token-ring products.

Network management

The first product in the new Open Network Management Family is OneView, Unix-based software that runs on a Sun Microsystems, Inc. SPARCstation and is designed to provide configuration, performance, security and fault management. The product consolidates existing element management offerings, including Proteon's OverView router management system, as well as its TokenView Plus and TokenView Manager, both of which are designed to manage token-ring adapters and IEEE 802.5 token-ring networks.

OneView, which can run locally or at a remote site and features a graphical user interface, is built on top of a network management software platform called NMC 3000 that was designed by Network Managers, a U.K.-based company.

Proteon considered other integrated network management platforms, such as SunConnect's SunNet Manager and Hewlett-Packard Co.'s OpenView, but chose little-known Network Managers because it agreed to help Proteon develop a Microsoft Corp. Windows 3.0-based version of OneView over the next six to nine months, said Kumar Shah, a senior product manager at Proteon. OneView supports SNMP Management Information Base (MIB) I and II, as well as Proteon's extended MIBs and the extended MIBs of other vendors, such as Chipcom Corp., Cisco Systems, Inc. and Retix, Shah said. One reason Network Managers' product was attractive is that applications that manage devices from Chipcom, Cisco and others have already been developed for the platform.

Beginning in February, OneView will be available in several flavors. OneView Infrastructure Manager, which can manage all Proteon equipment and other vendors' SNMP-based devices, will cost $15,995. OneView/Router Manager, for managing Proteon routers, costs $9,995, while OneView/Token Ring Manager, which controls Proteon's Series 70 and 90 hubs, ranges in price from $5,495 to $12,995.

SNMP/Token Ring Agent

Included in the price of OneView is Proteon's new SNMP/Token Ring Agent (SNMP/TR) software, Shah said. SNMP/TR was designed as part of Proteon's SNMP Foundation strategy, which calls for Proteon to develop SNMP agent software for all its products.

The SNMP/TR software runs on a DOS-based personal computer and monitors SNMP data sent across a token ring by Proteon hubs and other SNMP-based devices. The SNMP/TR software, which can run in a background mode on a PC, feeds the SNMP data to any SNMP-based management system, such as OneView.

Unlike other SNMP hub agent implementations, a single PC running Proteon's SNMP/TR software can be used as a proxy for multiple hubs. Most other vendors implement agents in a module on each hub or on each component within the hub.

Jim Harrison, a program director for Global Networking Strategies at the META Group, a Westport, Conn., consulting firm, said Proteon's management approach is inexpensive and flexible. He added, however, that the PC running the SNMP agent software could go down and might not be as reliable as running the SNMP agents on the hubs themselves.

The SNMP agent software is also a critical part of Proteon's strategy to ensure that its products can be managed by umbrella management systems, such as IBM's NetView, AT&T's Accumaster Integrator and Digital Equipment Corp.'s Management Control Center (DECmcc) Director.

(continued on page 39)

FCC allows RBHC to offer ONA

continued from page 4

disappointed that the Ameritech tariff was not suspended while the FCC investigates pricing and that the evidence presented by critics was more than enough to warrant blocking the tariffs. "There's no economic rationality in any of this stuff," he said.

In order to figure ONA rates, carriers must take previously bundled services and sort out what each service element costs. The carrier must also figure costs for new services rolled out under ONA, which involves a certain amount of guesswork in determining the cost of providing service, customer demand and other variables.

Figuring ONA rates was so complicated that Ameritech developed a computer model, dubbed Switching Cost Information System, to sort out the various costs.

Usually, carriers are required to submit data to the FCC showing exactly how rates are computed. But Ameritech and the other RBHCs said filing all of the data would reveal proprietary information.

However, carriers and the Ad Hoc Committee, which represents potential corporate ONA customers, said that without detailed information, it is impossible to determine if prices are appropriate. ☐

INDUSTRY UPDATE

VENDOR STRATEGIES, MARKET TRENDS AND FINANCIALS

Worth Noting

> "We've got a push me-pull you relationship with Groupe Bull. As a vendor-neutral systems integration firm, we need to keep our distance. Then again, [Groupe] Bull has many good products for us to recommend and a customer support organization we can use."

Steve Gardner
President
Integris, the systems integration subsidiary of Groupe Bull
Billerica, Mass.

People & Positions

CrossComm Corp., a Marlborough, Mass., maker of token-ring bridges and routers, recently announced the hiring of two former Wang Laboratories, Inc. staff members.

Helen Wong-Reynolds has been named vice-president of engineering, a newly created position. She will be responsible for research, development and product engineering of CrossComm's internetworking products. Prior to joining CrossComm, Wong-Reynolds was director of research and development at Wang Labs.

Also, **Robert Koch** was named to the new position of director of product marketing. He will be responsible for strategic product planning, program management and vendor relations. Previously, Koch was senior product manager for personal computer client/server products at Wang Labs.

David Beardsley, a former Novell, Inc. vice-president, last week was named to the newly created position of

(continued on page 10)

Law slaps stringent rules on telemarketing firms

Calls for creation of national 'do-not-call' database.

By Ellen Messmer
Washington Correspondent

WASHINGTON, D.C. — President Bush recently signed into law a bill placing new restrictions on the telemarketing industry, including a requirement that outbound calls be checked against a national "do-not-call" database.

The new rules are designed to bring quality control to telemarketing and may boost the fortunes of equipment suppliers that are able to supply systems capable of database screening.

Under the Telephone Consumer Protection Act of 1991, residential users will have the opportunity to place their names in a national database of "subscribers who object to receiving telephone solicitations."

While Bush praised the bill's purpose of protecting privacy rights of phone users, he expressed misgivings that the bill could negatively impact the telemarketing industry, a sector that contributed an estimated $430 billion to the economy in 1990.

About 300,000 telemarketing agents call more than 18 million people a day — but Sen. Ernest Hollings (D-S.C.), who introduced the bill later backed in the House by Rep. Ed Markey (D-Mass.), said too many of those calls are annoying and intrusive. Sen. Larry Pressler (R-S.D.) suggested the idea of the do-not-call database.

The bill contains new rules that prohibit the use of prerecorded voice messages under almost all circumstances and bans the use of predictive or automatic dialers in conjunction with facsimile or paging systems.

But these two bans raised few outcries from the telemarketing industry, which dismissed these types of calls as a quantitatively insignificant segment.

Deeper concerns lie with how the Federal Communications Commission will implement the database and what expenses may be added to marketing overhead to access and screen any potential call list against it. Nonprofit corporations are the only types of business organizations exempted from the bill's requirements.

Charles Carney, chief executive officer and president of Davox Corp., a maker of predictive dialing systems that dial from selected databases until an answered call is handed to a live agent, suggested that the FCC's

(continued on page 10)

INDUSTRY BRIEFS

Venture money keeps Coral afloat. Coral Network Corp., a Marlborough, Mass., local-area network internetworking start-up, last week said it received a $4 million investment from investors that will bail out the financially ailing company.

John Thibault, Coral's president and chief executive officer, said Sevin Rosen Funds and Gibraltar Trust came through with the second round of venture financing, which is slated for product development and market expansion. The company's initial venture seeding was used to develop the Broadband Enterprise Switch, which is expected to ship in March.

Thibault said the company ran out of money two weeks ago but said the new infusion of funds will keep the company going through 1992.

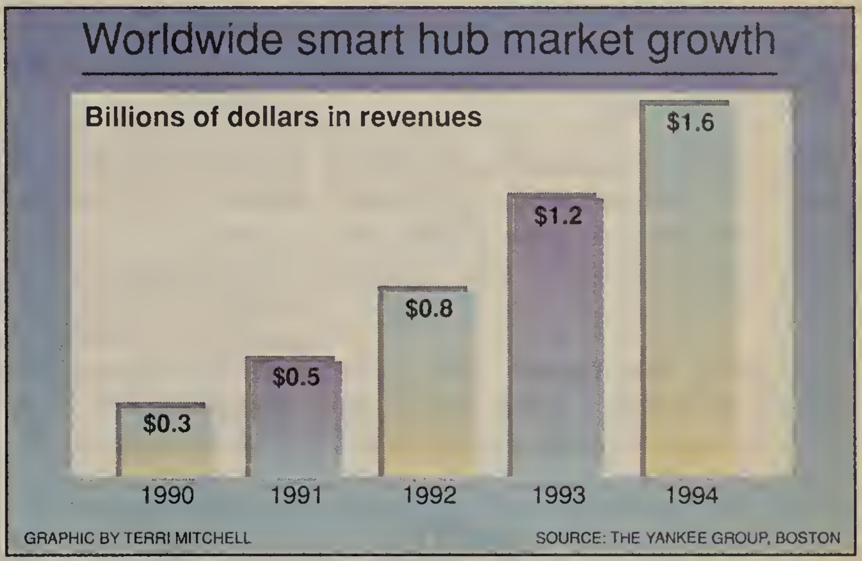
Report sees net growth. The Department of Commerce last week issued its annual Industrial Outlook report for 1992, which predicted the U.S. computer equipment industry would increase 4% to nearly $61 billion this year. However, the U.S. computer trade deficit is expected to exceed $1.5 billion, due to higher growth in imports and less demand for U.S. exports as well as continued movement offshore by U.S. manufacturers.

"The computer networking market shows no signs of slowing," the report stated, predicting that the total worldwide local-area network market would grow to $10 billion in 1992, a 24% increase over 1991.

The report said the market for personal computer LANs

(continued on page 10)

Worldwide smart hub market growth



GRAPHIC BY TERRI MITCHELL

SOURCE: THE YANKEE GROUP, BOSTON

IBM mulls entry into flexible hub market

Vendor says customers clearly need hub for FDDI, E-net and token-ring nets, weighs several options.

By Bob Brown
Senior Editor

IBM is exploring the possibility of developing an intelligent wiring hub to appease customers who need to integrate their Ethernet, Fiber Distributed Data Interface and token-ring nets, *Network World* has learned.

IBM officials refused to disclose details regarding the company's intentions to participate in the intelligent wiring hub market but acknowledged a growing user demand for high-end, flexible wiring hubs.

Analysts said it is likely IBM initially will enter into a reseller relationship with other hub vendors, which will buy the vendor ample time to develop its own product.

By providing a heterogeneous wiring hub, IBM could offer users a more flexible system than its 8230 controlled access unit, which is a token-ring hub with more intelligence than a basic multistation access unit (MAU). This would position IBM as a single source for a user's entire token-ring and hub gear.

"We understand and believe that we should participate in the hub market for not just token-ring, but also Ethernet and FDDI nets," said Joan Rennaker, a senior product administrator at IBM. "Right now, we are analyzing a number of options and one is to build our own intelligent wiring hub. Other options might be to have a partnership with another company.

"But at this time, we don't have an announcement," she added.

The intelligent wiring hub market is considered a desirable target for IBM given the strategic, central position that hubs typically play in local-area network enterprises. Hub sales can often lead to sales of network management software, routers, adapter cards and other devices attached to the hub.

Although IBM already would be late entering the hub market, many of the leading hub vendors only recently have begun emphasizing token-ring support — IBM's area of expertise.

Proteon, Inc., IBM's chief rival in the token-ring MAU and adapter card market, will only begin shipping its new Series 90 Intelligent Network Concentrator in January.

IBM's story

IBM's current hub strategy revolves around its 8230 controlled access unit, which is a low-end hub. While the managed 8230 is a step up from IBM's unmanaged 8228 MAU, it supports only token ring and is not modular in design.

Rennaker stressed that the 8230 itself is selling well to many customers who do not require hubs supporting multiple types of LANs. For these customers, the 8230 is a valuable device, despite the fact that it is less flexible than high-end hub systems, she said.

"While we agree that many of our customers have both token-ring and Ethernet networks, many of them don't have the cables coming to the same wiring closets or even want to have the wiring coming to the same closets," Rennaker said.

Still, users are increasingly looking for ways to interconnect various types of LANs, and hubs are an important piece of such wiring decisions, Rennaker said. IBM has already said it is interested in supporting FDDI, the

(continued on page 10)

Industry Briefs

continued from page 9

would reach $7 billion, a 27% increase over 1991, while the market for LAN interconnection devices — particularly routers — would grow to $2.7 billion, a 12.5% increase over last year.

"As the LAN market becomes saturated in the U.S., vendors will seek markets overseas," the report concluded. "The market for LANs in Europe will grow 16%, but not surpassing the 21% growth rate expected in the U.S."

Singling out fraud. The House Committee on Government Operations last week released a report indicating that telemarketing fraud in the U.S. is a pervasive problem, costing individuals and businesses from $3 billion to $15 billion annually.

The congressional report, noting that telemarketing fraud is an underreported crime, said the real costs to victims may be far higher.

The committee said the federal and state agencies responsible for tackling the problem have made little headway in resolving it.

Among its ideas for combating telemarketing fraud, the committee suggested the creation of a central database within the federal government of complaints against telemarketers or of ongoing law enforcement investigations. ◪

IBM mulls entry into flexible hub market

continued from page 9

emerging backbone technology of choice in many user networks, she said.

"As users are trying to get isolated islands of their LANs together, they have to ask about what the backbone should be," she said. "Should it be FDDI or token ring? And depending on what the answer is, what does the hub need to support?"

Filling a gap

Analysts said IBM's lack of an intelligent wiring hub is a major gap in its product line.

"IBM's got a make-or-buy decision before it to get into the smart hub market," said Todd Dagres, director of data communications research at The Yankee Group, a market research firm in Boston. "I think it'll have to get into the market in the short term with someone else's product because [it] won't be able to develop one fast enough. But in the long term, I see IBM getting into the market itself."

Joe Gottlieb, a senior research analyst at the META Group, a Westport, Conn., consulting firm, agreed and said IBM is likely to strike a reseller deal with a hub vendor soon.

"IBM's been getting killed by 10Base-T [Ethernet]," Gottlieb said. "IBM has recognized that it needs to get into the intelligent wiring hub market and support Ethernet in addition to token ring."

IBM has had discussions with all the major hub vendors about forming development or resale alliances but has yet to choose a strategic partner or partners, Dagres said.

Such an agreement should not be confused with IBM's recently announced deal with Cabletron Systems, Inc. under which Cabletron will sell IBM computers as platforms for Cabletron network management products and IBM can reference sell Cabletron hubs on a bid-specific basis. ◪

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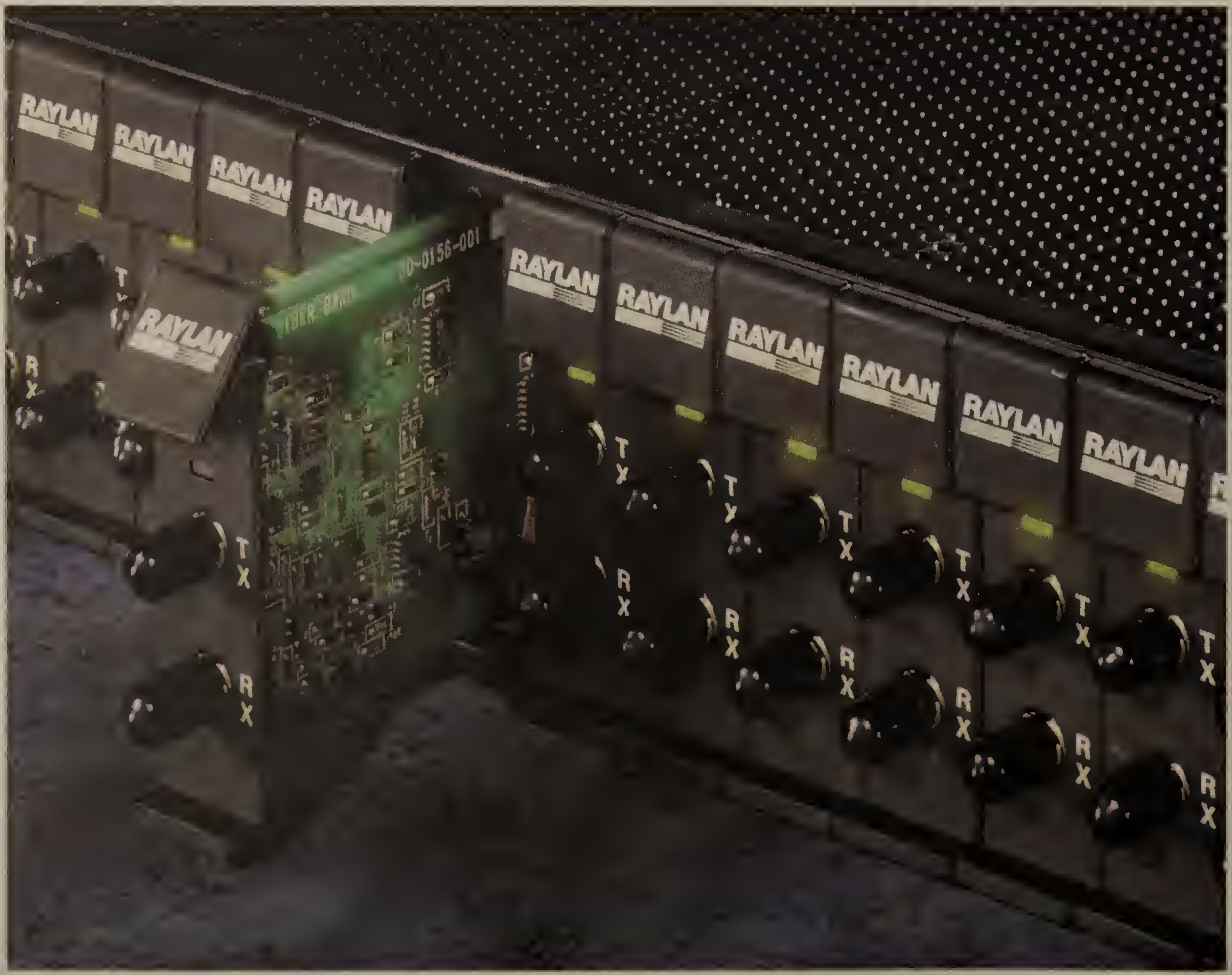

Law slaps rules on telemarketing firms

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do-not-call database "should have a simple dial-up capability."

Carney said software available with the Davox predictive dialer would be able to automatically download the do-not-call database and compare it against telemarketing lists.

Other predictive dialing systems, such as those from Rockwell International Corp.'s switching systems division, can also handle database comparison.

Carney predicted that users dependent on autodialers, the personal computer-based systems that dial a series of phone numbers to deliver a prerecorded message, will find themselves out of business under the bill, which goes into effect one year from now.

"Autodialer users should be very worried," Carney said. ◪

People & Positions

continued from page 9

vice-president of sales at **Tutankhamon Electronics, Inc.** in Pleasant Hill, Calif., which sells an Ethernet hardware product called MagicNet.

In his new position, Beardsley will direct both market and channel development and supervise all sales activities for Tutankhamon.

Previously, he was vice-president of sales for Combinet, a Los Gatos, Calif., maker of Integrated Services Digital Network terminal adapters.

NetWorth, Inc., a Dallas manufacturer of local-area network wiring hubs, recently named **Martin Lattman** as vice-president of marketing. His responsibilities will include product management and strategic planning.

Previously, Lattman was vice-president of marketing for Teknekron Infoswitch Corp., a voice processing firm in Fort Worth, Texas. ◪

TELECOMMUNICATIONS

CARRIER SERVICES, CENTREX, CPE, WIRING SYSTEMS AND BYPASS

Worth Noting

MCI Communications Corp. last week decommissioned a 30-mile analog microwave link near York, Pa., thus completing the digitization of its nationwide network. During the past 16 months, MCI retired 15,300 analog route miles.

Carrier Watch

Indiana Bell Telephone Co. recently announced the sales of digital Centrex service to Purdue University Calumet in Hammond, Ind., and Community Hospital North in Indianapolis.

Purdue University Calumet signed a seven-year contract for a 750-station digital Centrex that will serve its entire campus in Hammond. An existing AT&T Network Systems 5ESS switch in Indiana Bell's Hammond East central office will serve the school.

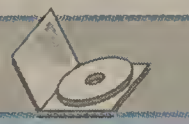
"The [Centrex] will be used to improve communications and networking at the campus and to help develop student applications such as LAN-to-LAN operations and ISDN," said Bob Hopper, associate director of computing and telecommunications services for the university.

Community Hospital North signed a five-year contract for a 330-station digital Centrex to serve eight locations in Indianapolis.

Indiana Bell will use at least one Northern Telecom, Inc. DMS-100 remote switching module to serve the sites. The Centrex will allow five-digit dialing between any location on the system.

"The [Centrex] will provide our locations with a cost-effective communications network, as compared to our off-premise extension capability," said Ed Koschka, Community Hospital North's vice-president of information services. ◪

Pros and cons of various billing media

Delivery media	Pros	Cons
Paper	☐ Detailed	☐ Too large and unmanageable ☐ Expensive to ship
Magnetic tape	☐ Manageable ☐ Uses existing tape drives	☐ Can tie up a large computer
EDI	☐ Direct host-to-host delivery ☐ Eliminates paper	☐ Can be expensive
CD 	☐ Inexpensive ☐ High-density capacity	☐ Not widely available

GRAPHIC BY SUSAN J. CHAMPENY

MCI to offer compact discs as Vnet bill delivery option

Will ultimately widen program for other services.

By Bob Wallace
Senior Editor

WASHINGTON, D.C. — MCI Communications Corp. recently announced plans to deliver bills on compact discs to enable users to process them more easily and at a lower cost.

The CD bills, which are expected to be available in the second half of 1992 for customers of MCI's Virtual Network (Vnet) service, would simplify the handling of call detail data currently delivered on reams of paper, numerous computer tapes or via electronic data interchange connections.

MCI teamed with Eastman Kodak Co. to develop CD billing and is the first of the Big Three to offer the option. AT&T would not say if it plans to follow suit, and US Sprint Communications Co. said it has no immediate plans to offer the option.

But Fred Geyer, associate director of Eastman Kodak's image research laboratories, said AT&T, US Sprint and other major carriers have expressed interest in CD billing.

MCI, like its rivals, currently offers three billing options: It can send billing data to a regional center to be printed out, write billing data to magnetic tape for delivery to customers or allow users to download data from MCI mainframes via EDI links.

Geyer said the CD option will be the easiest and least expensive billing method for MCI and its customers. For example, an average Vnet bill fills 16 boxes, which are then loaded onto wooden pallets and shipped to the customer.

"When you consider the cost of shipping pallets across the country or the time needed to transmit an enormous amount of billing data over a low-speed EDI [link], it makes good economic sense to look at the CD approach," Geyer said.

MCI said it does not plan to charge users for the CD billing option. Customers need a DOS-based personal computer and a CDROM drive, which Geyer said range in price from $260 for an internal unit to $900 for a standalone version. Users must also run MCI Perspective, the carrier's telemanagement software, on the PC in order to read, manipulate and analyze the data.

MCI Perspective can be used to design custom reports as well as generate 24 standard reports, which are broken into four categories:

> Geyer said the CD option will be the least expensive method for MCI and its customers.
>
> ▲▲▲

- ■ Monitor Usage reports list the longest calls, most expensive calls, off-peak calls, most active identification/accounting codes or most active card numbers.
- ■ Analyze Traffic reports include summaries by ID/accounting code, card number, rate period, call duration or historical usage.
- ■ Check Call Frequency reports isolate areas most frequently called and list most frequently dialed numbers, area codes, cities, states and countries.
- ■ Summarize Destination reports detail traffic by geographic destination.

MCI plans to provide call detail on CDs for other services but would not say when. ◪

AT&T whittles away SDN billing troubles

But users are still grappling with the carrier over the provisioning of SDN switched access sites.

By Bob Wallace
Senior Editor

AT&T has resolved many of the billing problems that have long been the Achilles' heel of its Software-Defined Network (SDN) service, but some users are still dissatisfied with efforts to improve provisioning of switched access, another long-standing SDN problem.

Customers are giving AT&T high marks for rectifying a history of late, inaccurate and incomplete SDN bills. Eight to 12 months ago, "SDN billing was a complete zoo," said Russell Fiske, corporate telecommunications vice-president of C&S/Sovran Corp., a Richmond, Va., bank.

Problems included bills that arrived late with incorrect usage charges and did not have list charges for some bank locations. "We had several instances where a site that was averaging $25,000 a month [in usage charges] would suddenly drop down to $10,000 for a month," Fiske said. "Then four or five bills later, that same site would be charged $40,000 to make up the difference."

The bank worked directly with AT&T and the SDN Users Association to address the problem, which was ultimately resolved last spring. "Overall, we are quite pleased with AT&T's response and performance," Fiske said.

Billing problems were not restricted to C&S/Sovran. Larry Moreland, SDN Users Association president and a network manager at Caterpillar, Inc., admitted that many users have complained to AT&T about SDN billing problems at user group meetings.

"Billing [correction] is a top area for users" he said. "But it seems that the situation is improving."

Caterpillar has experienced only a few minor problems with SDN billing. "We're happy with SDN," Moreland said. "You're always going to have some small problems, but we haven't had any showstoppers."

Liberty Mutual Insurance Co. has also had no significant problems. "We've never had major problems, but we had a few inaccuracies," said Dick Schepler, Liberty Mutual's network manager and a member of the SDN Users Association. "But they have been corrected, and there have been no recurrences."

While users are pleased with the strides that AT&T has made to improve SDN billing problems, they are split on the carrier's efforts to solve long-standing provisioning woes.

"Billing has gotten better, but provisioning is still far too slow," said Tom O'Toole, a network manager with Westinghouse Communications in Pittsburgh.

O'Toole manages an SDN that links between 50 and 70 locations throughout the country. Despite AT&T assurances that provisioning will improve, the situation has not changed, he said.

Users that are continually adding and dropping SDN sites seem to have the most problems, such as Circle K Corp., a retail chain with a 3,900-site SDN linking stores in 38 states.

"We've been using SDN for over two years now, and we love it," said Harry Heintz, Circle K's former communications manager. "But I haven't seen any improvement in the provisioning process.

"[AT&T] sounds good when they're making promises to turn things around, but so far, that's just talk," he said.

According to Schepler, "It took AT&T 15 to 18 months to get over 200 of our small offices up on SDN, which was intolerable."

But complaints and pressure from the SDN Users Association persuaded AT&T to dedicate more resources to the problem, which is helping to turn the situation around.

"We are pleased with and enthusiastic about AT&T's progress in this critical area," Schepler said. "Now they are provisioning switched [SDN] access in about 45 days and are shooting for 30, which would be remarkable."

He added that shorter switched access provisioning intervals are, in part, the result of AT&T's efforts to move resellers to other services.

Although AT&T declined to discuss specific steps it has taken to address SDN billing and provisioning problems, the carrier did say it has dedicated more people and resources to their resolution.

"We still have a ways to go as far as improving the billing and provisioning processes," said Lance Zingale, AT&T's division manager for outbound product management. "But users will definitely see further improvements throughout 1992." ◪

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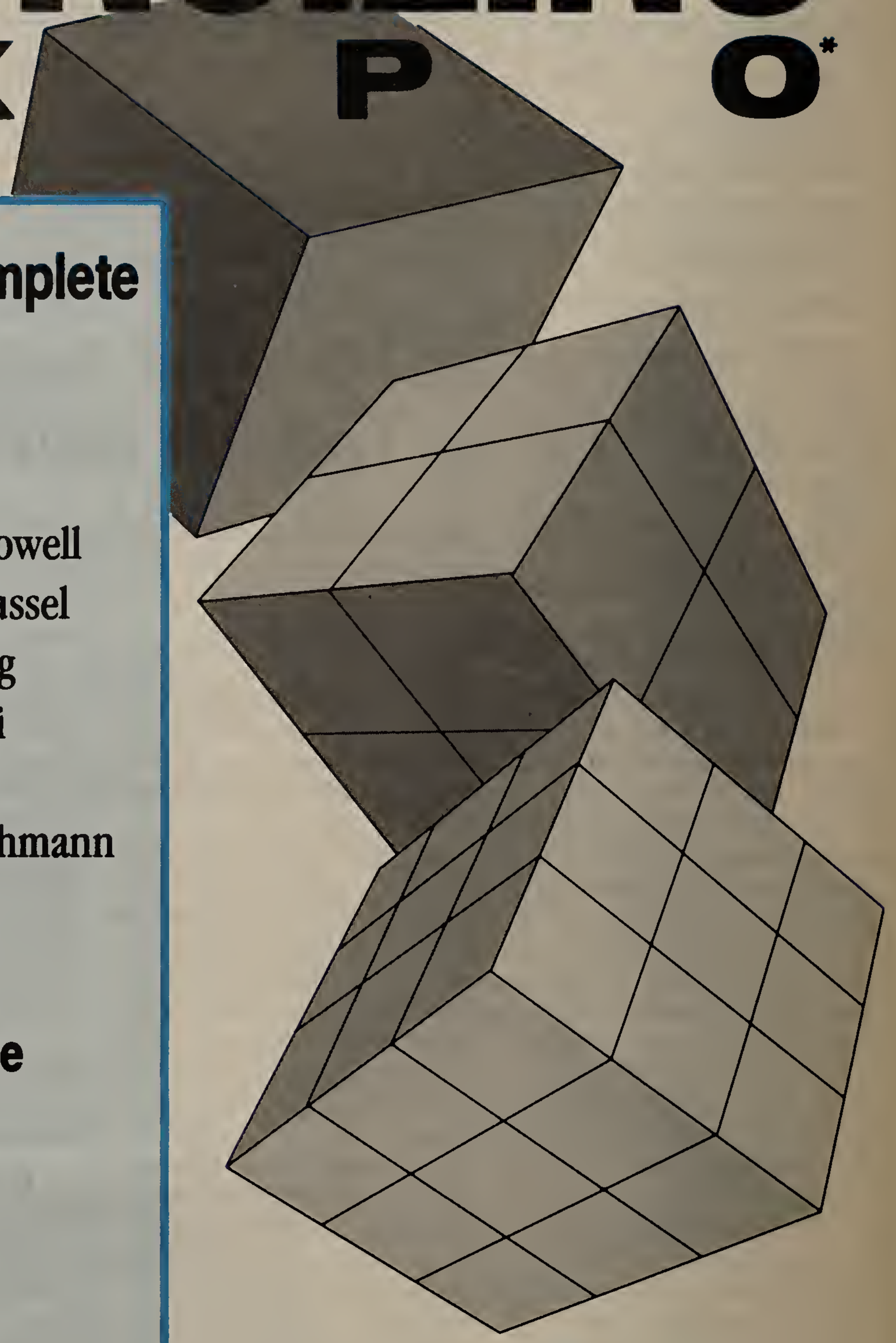

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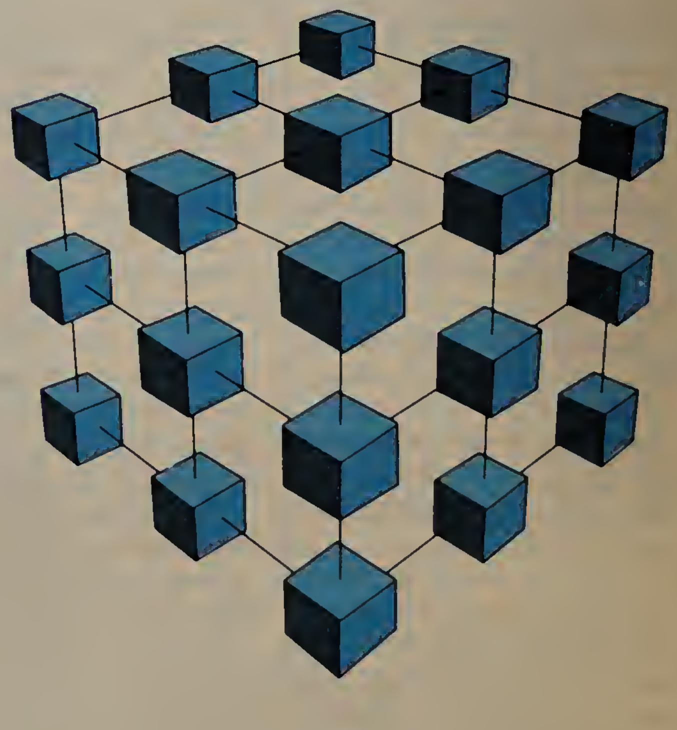

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DATA COMMUNICATIONS

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Worth Noting

Over 375,000 facsimile machines capable of printing on plain bond paper are expected to be sold in 1992, according to BIS Strategic Decisions, a consultancy in Norwell, Mass. Also, according to a BIS survey, good resolution and fast transmission speed are the two most important features users consider when looking for fax machines. Memory was a distant third.

Data Packets

Advanced Compression Technology, Inc. (ACT) plans to announce its new SDR-64 and SDR-128 digital radios at the ComNet conference and exposition later this month in Washington, D.C. The radios operate at 64K and 128K bit/sec, respectively, and can be used instead of leased lines, wire-line modems and analog radios for last-mile links to digital backbone networks.

The SDR-64 and SDR-128 utilize 50 kHz and 100 kHz of bandwidth, respectively, which ACT claims is more efficient than other digital radios in their class. This will simplify Federal Communications Commission licensing of usable frequencies. The radios operate with a high degree of reliability at distances up to 35 miles.

Typical applications for the SDR series include rural areas with difficult terrain or no telephone infrastructure. Another application is in metropolitan areas, where the radios can be used to avoid the recurring cost of leased lines.

When the radios are used with ACT's SDM-T Voice/FAX/Data Flexiplexer multiplexer, a maximum of eight

(continued on page 14)

ISDN videoconferencing to help bank cut service costs

Huntington Bancshares plans on-demand service.

By Paul Desmond
Senior Editor

COLUMBUS, Ohio — Huntington Bancshares, Inc. is testing a terminal that supports ISDN-based videoconferencing, a capability the company expects will help it cut the cost of delivering bank services to customers.

Using a modified NCR Corp. 5682 self-service terminal, Huntington Bancshares plans to let customers at bank branches establish on-demand videoconference connections to a centrally located team of experts who can answer questions.

"To survive in the '90s, you have to be a least cost producer of retail banking services," said Bill Randle, director of marketing and strategic planning for Huntington Bancshares, a bank holding company based here. "Along with home banking through telephones, this really allows banks to attack the cost of retail delivery."

To support the video link, the NCR 5682 terminal is being outfitted with video technology developed in conjunction with AT&T Bell Laboratories, said Steve Grzelak, market manager for new service development at AT&T Network Systems. The terminal supports a 112K bit/sec video link and 16K bit/sec voice connection, both of which are delivered over an Integrated Services Digital Network Basic Rate Interface line.

The prototype 5682 uses a video coder/decoder from Compression Labs, Inc., although Grzelak said work is under way to port the codec function to a personal computer board that could fit in the 5682.

He said the 5682 enhancement is one of the first fruits of AT&T's acquisition of NCR.

Huntington Bancshares plans to install the terminals at a small number of locations by mid-1992 as part of a larger strategy called direct banking, Randle said. The strategy will include the use of AT&T "smart phones," which are

(continued on page 14)

DEC plans partnerships for mobile net offerings

By Jim Duffy
Senior Editor

ANAHEIM, Calif. — Digital Equipment Corp. is negotiating with suppliers of pen-based computers and wireless networks in an effort to add mobile computing capabilities to its distributed networks portfolio.

Grant Saviers, DEC's vice-president and group manager of PC Systems and Peripherals, said the company is looking to partner with suppliers of lightweight computers and mobile networks "to make the technology viable in a client/server environment."

"Mobile computing is in its infancy," Saviers said during the keynote presentation at a Digital Equipment Computer Users Society symposium here. "We think one of our opportunities is to integrate it into our client/server vision. We think there's a tremendous opportunity there for us. We're looking at various product and technology alternatives at this point."

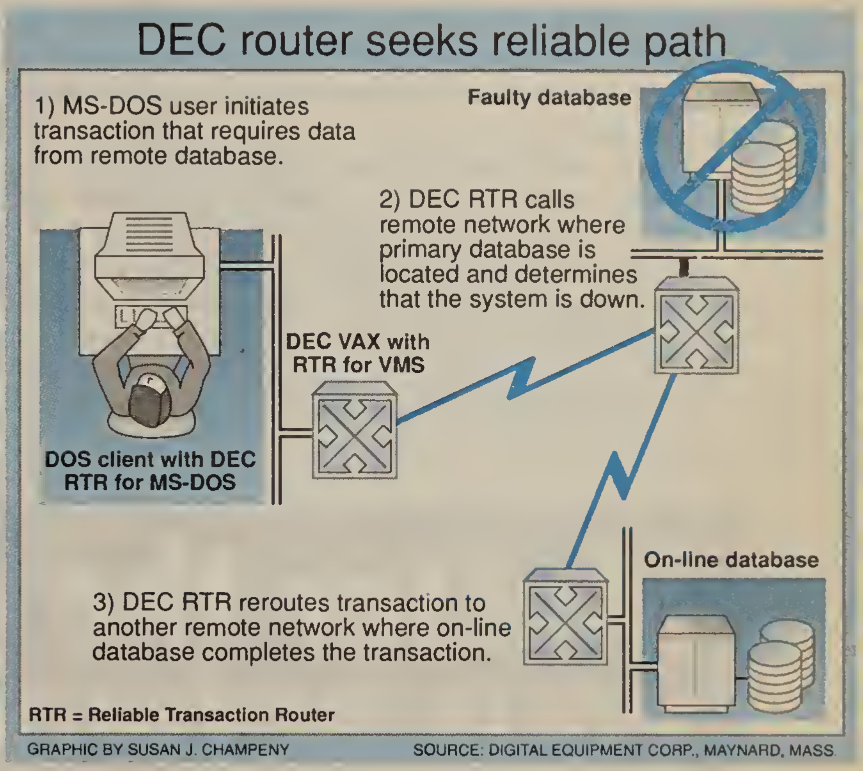
Saviers did not disclose what type of product DEC was considering or when it might be released. But analysts said it may be something similar to a personal computer equipped with a wireless modem that IBM introduced earlier this year.

Among those DEC is in discussion with are Microsoft Corp. and GO Corp., which develop pen-based operating systems, and ARDIS Co. and LM Ericsson A/S, which run wireless radio nets.

"They're realizing that they don't have a lot of expertise in this area," said analyst Chris Christiansen of the META Group, in Westport, Conn. "They're waiting for products to emerge."

Pen-based computers and wireless networks have compelling implications for companies that deploy field sales representatives. Representatives can travel from customer to customer, handwrite order entries into their computers and upload those entries to a host computer over a wireless radio network accessed through a cellular modem.

Likewise, manufacturers and suppliers of the devices and networks can tap into a huge and lucrative market given the vast number of companies that depend on a direct sales force, analysts said. "That's a real hot area," Christiansen said. ▣


DEC router seeks reliable path
1) MS-DOS user initiates transaction that requires data from remote database.
Faulty database
2) DEC RTR calls remote network where primary database is located and determines that the system is down.
DEC VAX with RTR for VMS
DOS client with DEC RTR for MS-DOS
On-line database
3) DEC RTR reroutes transaction to another remote network where on-line database completes the transaction.
RTR = Reliable Transaction Router
GRAPHIC BY SUSAN J. CHAMPENEY
SOURCE: DIGITAL EQUIPMENT CORP., MAYNARD, MASS.

DEC software helps fulfill PC requests

DEC RTR for MS-DOS can find alternate route, back up host processor should primary route fail.

By Jim Duffy
Senior Editor

MAYNARD, Mass. — Digital Equipment Corp. recently unveiled software that protects transactions initiated by MS-DOS personal computers from system failures on a local- or wide-area network.

The DEC Reliable Transaction Router (RTR) software for MS-DOS runs on LAN-attached PCs and interacts with a VMS version of the software to ensure a transaction is processed, even if a primary processor is off-line and the transaction has to be routed to an alternate system.

The software is targeted at transaction processing environments, such as those found in banks, brokerages and other financial institutions that rely on distributed networks, multiple partitioned databases or conversational messaging between clients and servers.

RTR for VMS

DEC RTR for MS-DOS is the second RTR software package unveiled by the vendor. DEC introduced DEC RTR for VMS last year ("DEC pack lets users build redundant data centers," *NW,* Nov. 11, 1991).

DEC RTR for MS-DOS connects PCs to VMS servers and routers running DEC RTR for VMS software.

Once a transaction is initiated from the desktop, it is handed off to a server or router that looks up the intended destination in its routing tables. If a transaction processing machine is unavailable, DEC RTR for VMS reroutes the transaction to another device supporting the appropriate transaction processing application.

"RTR treats the whole thing as one virtual network," said Dave Zwicker, DEC's transaction processing system marketing manager.

PC client applications can invoke DEC RTR by using asynchronous or synchronous requests. The process is transparent to the MS-DOS user, DEC said.

DEC RTR for MS-DOS includes an application program interface that allows developers to build third-generation language transaction processing applications that shield the user from dealing with underlying network configuration and transport mechanisms or knowing precise database locations.

> DEC RTR for MS-DOS connects PCs to VMS servers and routers running DEC RTR for VMS software.
>
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DEC RTR for MS-DOS also enables a network administrator to define a hierarchy giving routing preferences to higher priority

(continued on page 14)

Videoconferencing to help bank cut costs

continued from page 13

telephones outfitted with modems and a text display screen that customers can use to conduct bank transactions from home.

The 5682 terminal is used at bank branches or locations such as supermarkets to let customers review accounts and get information on bank products and rates, for example. It is also equipped with a printer that can produce statements, loan forms and other types of information that customers may want in hard-copy form, Randle said.

By late 1992, Huntington Bancshares plans to form a centralized center manned around the clock with banking experts. That will enable customers at home or at the new 5682 to get their banking questions answered at any time.

Such developments are intended to lower the personnel costs associated with retail delivery of banking services, which Randle said typically account for 65% to 70% of a bank's total overhead.

For its part, NCR said it intends to provide the videoconferencing function on its entire line of self-service terminals.

Grzelak said the technology could be applicable to a number of businesses, such as automotive clubs, which could differentiate themselves by providing information to members via terminals located in airports and hotels. ◪

DEC software helps fulfill PC requests

continued from page 13

transactions. By doing so, DEC RTR for MS-DOS ensures users that a transaction will be processed, even if a primary transaction processing engine fails or is cut off from client workstations due to a communications outage.

DEC RTR for MS-DOS supports DECnet and the Transmission Control Protocol/Internet Protocol as well as Microsoft Corp.'s Windows graphical user interface, according to the vendor.

Unix versions of DEC RTR client and server software are on tap, Zwicker said. The company is planning to offer versions of the RTR software that run on IBM and Tandem Computers, Inc. processors positioned as back-end transaction processing servers.

DEC is also evaluating Apple Computer, Inc. Macintosh clients for inclusion in RTR environments, but the vendor "hasn't had a lot of pull" from customers for Macintosh support, he said. OS/2 clients and servers have not been in demand from RTR customers either.

Zwicker said DEC RTR will support other protocols besides DECnet and TCP/IP as the need arises.

DEC RTR for MS-DOS is priced at $275 per client. It requires DEC's Pathworks client software for the DECnet and TCP/IP protocol support. ◪

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Data Packets

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voice, four facsimile and six data channels are available.

Scheduled to be available in March, the SDR-64 costs less than $7,000, while the SDR-128 will cost under $9,000.

Also at ComNet, ACT plans to unveil ACTview, a personal computer-based network management system for its SDM-T Flexiplexer muxes. ACTview, based on Microsoft Corp. Windows, lets users manage a maximum of 64 SDM-T units. Functions supported include full-screen color maps that show network devices and connections, plus downline loading of software and configuration changes.

The software is expected to be available in March for $1,000.

For more information, contact ACT at 685 E. Cochran St., Simi Valley, Calif. 93065, or call (805) 527-2281.

IBM recently named **Process Software Corp.** of Framingham, Mass., as an IBM Business Partner. Process Software will market its CompressNET family of Transmission Control Protocol/Internet Protocol data compression software for wide-area networks to run on IBM AIX-based RISC System/6000 workstations.

CompressNET reduces TCP/IP traffic on WANs at ratios of up to 18-to-1 for applications such as image and bulk data transfers. The compression ratio for binary files ranges from 2-to-1 to 3-to-1.

CompressNET runs on a server and automatically captures and compresses all TCP/IP data that passes through it, requiring no end-user intervention.

It is priced from $3,790 for two licenses, which includes one year of maintenance.

SunGard Recovery Services, Inc. of Wayne, Pa., recently announced that it has doubled its Digital Equipment Corp. recovery capacity with the installation of two VAX computers at two hot sites.

At SunGard's Atlanta MegaCenter, the disaster recovery company installed a VAX 6620 processor and 256M bytes of storage, more than doubling the VAX computing capability at that site. At the Philadelphia MegaCenter, SunGard replaced a VAX 8820 with a 6440, nearly doubling the processing capacity of that hot site. The new VAX 6440 provides 128M bytes of storage.

Both sites have also been fitted with DEC and DEC-compatible RA92 disk drives. Atlanta will add almost 14G bytes of DEC-compatible disk space, while Philadelphia will gain 3G bytes of RA92 drives.

The equipment is operational now. ◪

LOCAL NETWORKING

PC AND TERMINAL-TO-HOST LANS, GATEWAYS AND MICRO COMMUNICATIONS PRODUCTS

Worth Noting

Wireless LAN technology will not be a replacement product for traditional wire-based local-area networks, according to a report by International Data Corp., a market research firm in Framingham, Mass. The report bases its conclusion on the small number of wireless LAN nodes that were shipped worldwide in 1991 — about 24,000, or 0.3% of all personal computer LAN nodes shipped.

Netnotes

Hewlett-Packard Co. recently released new versions of its expert system-based network testing tools to help local-area network administrators uncover LAN problems more easily.

Phase 2 of the HP tools includes the HP 4980A combination Ethernet/token-ring network advisor, the HP 4981A Ethernet advisor and the HP 4982A token-ring advisor. The new versions have been upgraded to include additional network diagnostic measurements and real-time analysis capabilities for testing net devices.

According to HP, based in Palo Alto, Calif., the enhancements are realized through an upgraded knowledge base that includes more than 100 intelligent net observations to help users identify common network faults.

Other new features include a token-ring network measurement for calculating the cable length of a single ring in a token-ring net, node statistics for Ethernet and token-ring nets that identify critical users, and new decode capabilities that expand testing.

Both the HP 4980A and the HP 4981A cost $20,300. All products are available now.

Firm offers TCP/IP, NFS software for DOS machines

New products improve application portability.

By Timothy O'Brien
West Coast Bureau Chief

DUNDAS, Ontario — Beame & Whiteside Software, Ltd. last week began shipping Version 2.3 of both its TCP/IP and Network File System (NFS) client software for DOS workstations.

Incorporated into the new versions of BW-TCP for DOS and BW-NFS for DOS is a new Application Interface Architecture (AIA), which allows applications that were created to run on commonly available Transmission Control Protocol/Internet Protocol transports to run over BW-TCP or BW-NFS without modification.

BW-TCP for DOS enables personal computers to participate in TCP/IP-based Ethernet or token-ring networks and includes VT-220, VT-100 and VT-52 Telnet as well as TN3270 terminal emulation. BW-TCP can support as many as eight simultaneous sessions to different hosts.

The new release of BW-NFS addresses compatibility problems for NFS-based databases accessed from DOS devices by solving a synchronization problem that results from differing processing demands between NFS and DOS. In DOS environments, typical database applications are run at the server, while in NFS, this often occurs at the workstation.

"PC database applications have had compatibility problems with NFS for a long time," said Carl Beame, president of Beame & Whiteside. "With the latest release of our NFS client software, we have eliminated the synchronization problems and now offer true NFS compatibility for DOS workstations."

The new version of BW-NFS enables DOS clients to use TCP/IP networks to access databases on Unix servers, Sun Microsystems, Inc.'s SunOS servers, Digital Equipment Corp.'s VMS servers and other platforms. The product has been successfully tested for NFS compatibility with a variety of client/server front-end database products, including Borland International, Inc.'s Paradox and dBase.

The new AIA also works with connectivity software from Oracle Corp. and Sybase, Inc. that supports TCP/IP environments.

In addition, AIA makes BW-TCP and BW-NFS call-compatible with TCP/IP applications developed for Sun's PC-NFS, FTP Software, Inc.'s PC/TCP and Novell, Inc.'s LAN Workplace for DOS 4.0.

Beame maintains that the company has made a significant effort to translate these third-party TCP/IP libraries into calls

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Asante airs hub offering, plans price restructuring

By Timothy O'Brien
West Coast Bureau Chief

SUNNYVALE, Calif. — Asante Technologies, Inc. today is expected to announce the 10THub/8, a low-cost eight-port 10Base-T Ethernet concentrator, and lower prices for its other hub and Apple Computer, Inc. Macintosh-based Ethernet cards.

With a price of $399, which translates to about $50 per port, the 10THub/8 offers the lowest cost per node of any 10Base-T concentrator, according to Asante. The company also lowered the cost of its 12-port 10Base-T concentrator, the 10THub/12, from $999 to $799, reducing the cost to about $66 per port.

In addition to its eight RJ-45 ports, the 10THub/8 includes a BNC port for connecting the hub into a coaxial cable-based backbone. The new concentrator also features autopartitioning, which shuts down faulty ports when jamming occurs, and Link Integrity on a port basis, which ensures compatibility with earlier 10Base-T equipment.

Both hubs are fully compatible with IEEE specifications for Ethernet and can be used with Novell, Inc.'s NetWare, Apple's AppleShare, Digital Equipment Corp.'s Pathworks and the Transmission Control Protocol/Internet Protocol.

Asante also announced price reductions of as much as 15% for its line of Macintosh Ethernet cards, including the MacCon+ and MacCon3. By lowering the cost to $249 for the MacCon+ boards for the Macintosh II, LC and SE computers — which support either thick or thin coaxial cable or thick coaxial cable and

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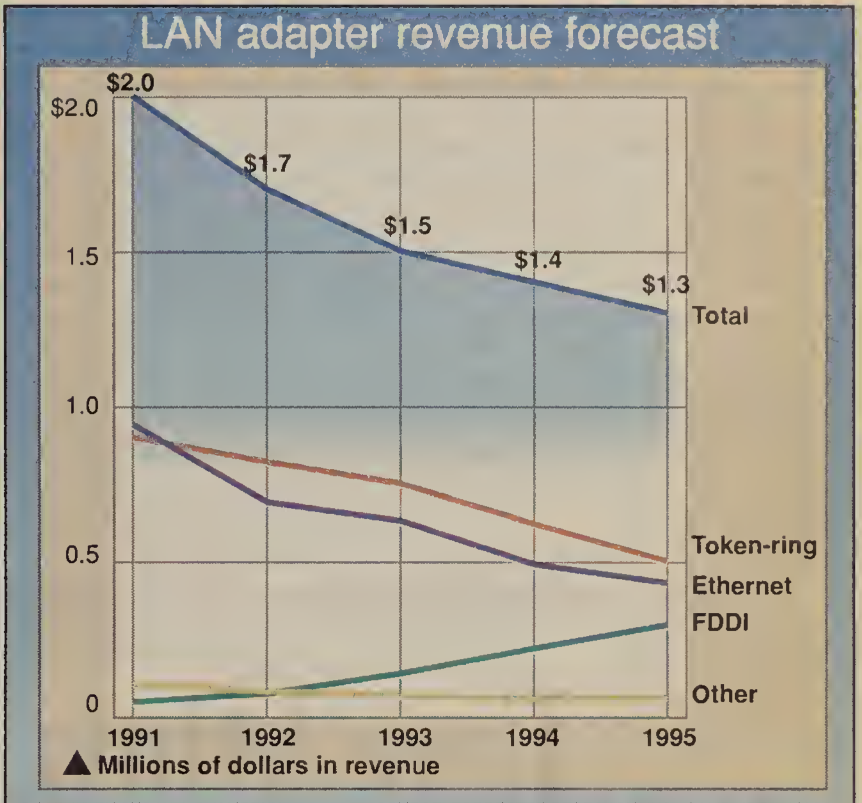
LAN adapter revenue forecast

GRAPHIC BY SUSAN J. CHAMPENY SOURCE: FORRESTER RESEARCH, INC., CAMBRIDGE, MASS.

Prices to plummet for LAN connectivity

Vendors now enjoy a stable mart, but study sees future slump as most PCs become networked.

By Caryn Gillooly
Senior Editor

It is no secret that fewer than half of all personal computers in use today are attached to local-area networks and that that percentage is expected to increase dramatically during the next few years.

But according to Forrester Research, Inc., LAN adapter card revenue is about to begin an irreversible decline as competition drives prices down and more vendors begin to build LAN ports directly into PCs.

The LAN equipment market is fairly stable today, according to Janet Hyland, director of network strategy research at Forrester, based in Cambridge, Mass. The Ethernet vs. token ring debate has quieted down and most agree that Fiber Distributed Data Interface will not become a major consideration for several years.

"The last few years have not been tumultuous," she said. "There hasn't been a lot of competition on the token-ring side, it's been status quo on the Ethernet side, and FDDI is still nowhere."

This stability is despite a slump in PC sales; about 94% of LAN boards are for PCs. Hyland said that instead of buying new PCs for LANs, customers are retrofitting existing PCs and attaching them to LANs. Once a majority of the current PCs are networked, however, LAN connection sales will begin to experience a similar slump.

The LAN connection decline will also be caused in part by laptop sales. According to Forrester, laptops will comprise upwards of one-third of all PCs shipped during this period and these machines will not be networked.

At about the same time, adapter card prices will begin a slow, steady descent. More vendors will break into the token-ring market previously dominated by IBM, increasing competition and bringing prices down. And the low cost of 10Base-T connections will bring down prices in the rest of the Ethernet market.

This drop in prices, which the study predicts will begin in 1992, will start the second part of a three-phase cycle. The first phase is the growth period currently being enjoyed by vendors, the second is the slump, and the third will be a mild recovery, according to the study.

The recovery will occur between 1994 and 1995 and will have three major causes, according to the study. First, PC shipments will recover — growing at 8% over prior years — and users will begin networking these PCs, the study said.

Second, PC vendors will begin to integrate LAN controllers onto PC motherboards. Until now, if a PC vendor wanted to include LAN connectivity options within a PC, it had to choose between Ethernet and token ring, risking the alienation of users that had the environment that the vendor did

(continued on page 16)

Prices to plummet for LAN connectivity

continued from page 15

not choose to support.

In the near future, however, companies such as Chips and Technologies, Inc. will be releasing dual-connectivity chipsets that include connections for both Ethernet and token-ring nets. This will significantly decrease the risk PC vendors face today.

The third reason driving the recovery of the LAN connectivity market will be the connection of laptops to LANs.

Forrester's report stated, however, that by 1994, "many of these portable computers will have LAN connections via integral controllers, small form-factor adapters or 'docking stations,' where a PC will slip into a desktop chassis complete with a hard disk, full-size monitor and keyboard, and LAN connection."

Despite the rebound, revenue from those connections will not be recouped, primarily because the LAN connections will be built directly into the PC. "By 1995, we project that 12% of all PCs shipped will contain on-board LAN connections," the study stated. "We estimate that in 1995, 1.1 million integral LAN controllers will be shipped in lieu of separate Ethernet or token-ring adapter cards."

All this boils down to one thing for users: inexpensive and easy LAN connectivity. "This is great news for users," Hyland said. "Basically, they pay less and less per LAN connection."

Forrester predicts users will benefit in three primary areas. First, because LAN connections are much less expensive, the money usually set aside for LAN connectivity will be able to be spent elsewhere.

Users will also experience fewer support headaches. "Integral LAN connections means higher reliability and reduced complexity of installing and troubleshooting networks," the study said.

Finally, customers will get more value from their PCs. "Cheaper, easier network connections means more PCs will sit on LANs," the study said. "Companies will become more 'free-flowing,' yielding better customer support, faster product development and easier globalization."

Firm offers software for DOS machines

continued from page 15

that are compatible with the AIA library.

To provide maximum flexibility of connectivity and limit workstation memory overhead, users can load and unload different AIA-compatible TCP/IP modules to support different TCP/IP applications.

This level of compatibility makes it possible to turn any PC into a client capable of accessing network resources and hosts running NFS. BW-NFS for DOS offers simultaneous access to as many as 24 virtual disks and eight printers.

Each AIA transport module consumes a small amount of workstation memory — typically from 1.8K to 5K bytes of random-access memory — and can be loaded into high memory to free up more RAM.

BW-TCP and BW-NFS are fully compatible with Microsoft Corp. Windows 3.X, with AIA using call-compatible dynamic link libraries to support different TCP/IP transports.

> Users can load and unload different AIA-compatible TCP/IP modules to support different TCP/IP applications.
>
> ▲▲▲

BW-NFS supports more than 90 Ethernet and token-ring adapter cards and can coexist with leading network operating systems, such as Novell's NetWare and Microsoft's LAN Manager.

BW-TCP for DOS and BW-NFS for DOS began shipping last week. BW-NFS for DOS costs $349. BW-TCP for DOS, which is integrated into BW-NFS, is also available as a stand-alone product at a price of $245. Customers with maintenance contracts will automatically receive an upgrade.

Existing Beame & Whiteside customers that do not have maintenance contracts will be able to upgrade to Version 2.3 for 10% of the list price until Feb. 1, 1992.

Asante airs offerings, restructures pricing

continued from page 15

10Base-T — Asante maintains it is the first vendor to break the $250 barrier for Macintosh Ethernet cards.

Wilson Wong, president and chief executive officer of Asante, said that MacCon+ cards offer a broad range of features, including full Apple System 7 compatibility, A/UX support, network diagnostic software, a five-year warranty and free telephone support.

Asante also reduced the price of the MacCon3 line of 3-in-1 Ethernet cards, which offer support for three media options — thick, thin and twisted-pair cabling — from $379 to $329 for the Macintosh II and SE. In addition, all MacCon3 cards come standard with 64K bytes of on-board random-access memory.

Prices for the MacCon+ and MacCon3 Ethernet cards for the Macintosh IIsi remained the same — $299 and $379, respectively — due to additional ports and sockets included on these boards.

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MANAGEMENT STRATEGIES

MANAGING PEOPLE AND TECHNOLOGY: USER GROUPS AND ASSOCIATIONS

Worth Noting

> "Network managers must get involved now and take control of LAN internetworks that have grown in a haphazard, anarchic fashion. It's too important to an organization's business objectives to be done otherwise."

Janet Hyland
Director of network
strategy research
Forrester Research, Inc.
Cambridge, Mass.

Association Watch

The **Association for Systems Management (ASM)** will hold its 45th Information Systems Conference May 3-6 at the Queen Elizabeth Hotel in Montreal.

The conference will include more than 35 sessions covering such topics as electronic data interchange and mid-range computing, as well as management briefings on information engineering, computer-aided software engineering, systems development and imaging.

The conference costs $675 for members and $775 for nonmembers. For more information, call Terri Gibbons at (216) 243-6900.

The **Association of Data Communications Users, Inc. (ADCU)** will hold its 1992 National Conference & Exhibit April 7-8 at the New York Vista Hotel in New York.

The conference will include seminars, panels, tutorials and open discussion sessions on data networking topics such as frame relay and image processing.

Vendor exhibits will be on display at the World Trade Center, which is adjacent to the Vista Hotel.

For more information, contact the ADCU's Augie Blegen at (612) 881-6803. ◘

GUIDELINES

BY ERIC SCHMALL

Net managers must take criticism constructively

I once heard a human relations consultant remark that we should accept each criticism as a gift. My first reaction was to dismiss this as typical human relations bilge. If this were true, I thought, net managers would be among the richest professionals in the information industry.

But over time, I discovered that the consultant was right. You can't improve your own performance or that of your group if all you do is look for compliments. Criticism is valuable for learning how to improve.

Most people flinch from taking bitter advice. Critical remarks can provoke anger and resentment. Some enlightened network executives may accept measured amounts of criticism, but only if they are heavily mixed with a syrupy coating: "You guys normally do a terrific job keeping the network up, but we've got to talk about these recurring T-1 outages."

Worse, customer service experts tell us that most customers — end users, in this case — don't complain openly to service providers. Only about one out of every 10 customers will take the time to register an official complaint. The rest will just become resentful, commiserating over their dissatisfaction.

This sets the stage for the classic tragedy where the provider thinks he's doing a great job and the user community becomes angry and alienated about service that never improves.

While accepting criticism is an important step in improving service, the real challenge lies in actively seeking criticism. Net managers can only provide outstanding service if they aggressively seek to identify and remedy weaknesses. They can't wait for individuals to offer honest feedback; they must probe users' perceptions continually.

Former New York Mayor Ed Koch made famous the saying, "How am I doing?" in an effort to get feedback from his constituents. While net managers should not adopt Koch's confrontational style of politics, they can take a cue from the ex-mayor and ask users, "How can we do better?"

A remarkable thing begins to happen when managers pursue this line of questioning. The process of soliciting feedback and being open to criticism builds rapport between users and network managers. Users become more willing to suggest reforms in a friendly, cooperative way.

By acting on ideas, the manager can rectify real and perceived problems. What was once an activity to be avoided will become a healing and growing process. ◘

Schmall is a network systems manager for an insurance holding company.

EXECUTIVE BRIEFS

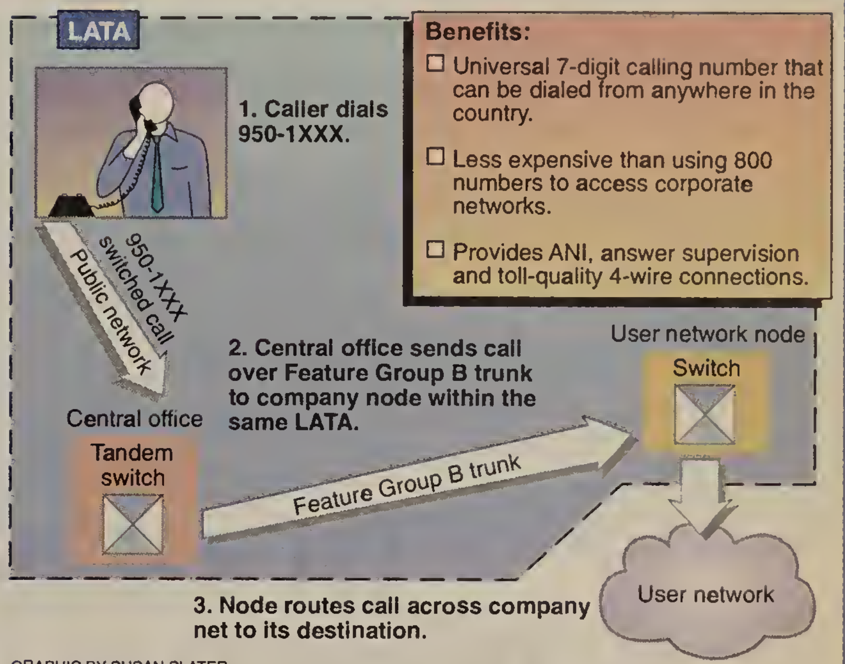
BY WAYNE ECKERSON

Parent track gains support. Executives at major companies believe that firms should offer a parent track, or slower career path, to allow working parents to spend more time with their families. That's according to a survey of 200 executives from the nation's 1,000 largest companies conducted by Robert Half International, a management recruiting firm in Menlo Park, Calif., that specializes in accounting, finance and information systems.

According to the survey, 92% of executives believe that employees are generally more concerned about balancing family duties and jobs today than they were five years ago. Nearly half of those surveyed said the number of executives willing to work long hours on a fast career track has decreased during the past five years mainly because they want to spend more time with their families. Also, more than two-thirds of those interviewed said firms should offer a parent track.

"Those companies that lead the way in instituting new policies to accommodate parent tracking will gain an advantage in attracting and keeping the highest quality employees," said Max Mesmer, chairman of Robert Half International. ◘

Rediscovering Feature Group B


LATA
1. Caller dials 950-1XXX.
950-1XXX switched call
Public network
Central office
Tandem switch
2. Central office sends call over Feature Group B trunk to company node within the same LATA.
Feature Group B trunk
User network node
Switch
User network
3. Node routes call across company net to its destination.

Benefits:

- ☐ Universal 7-digit calling number that can be dialed from anywhere in the country.
- ☐ Less expensive than using 800 numbers to access corporate networks.
- ☐ Provides ANI, answer supervision and toll-quality 4-wire connections.

GRAPHIC BY SUSAN SLATER

Users test toll-free net access options

Feature Group B lets customers use a common local number nationwide to access a backbone.

By Wayne Eckerson
Senior Editor

Many companies are beginning to discover the value of a predivestiture local access method known as Feature Group B that enables them to use a single nationwide number to provide toll-free access to their wide-area network at half the cost of 800 service.

Originally used to access alternative long-distance carriers, Feature Group B numbers — which use the 950 exchange — are being employed by a growing number of companies with large private networks for applications ranging from customer service to transaction processing.

Last summer, Domino's Pizza, Inc. announced plans to enable customers to use its 950-1430 number anywhere in the country to order pizza. Sears, Roebuck & Co., which owns the Discover Card, provides retailers with a 950 number to access Sears' network to process point-of-sale transactions.

Feature Group B trunks provide automatic number identification, answer supervision and four-wire connections for toll-quality transmission.

To use Feature Group B access, companies must have a network node in every local access and transport area in which they want to offer their 950 number. This restricts Feature Group B to firms with geographically pervasive private networks, such as large national retailers, state governments and carriers.

For example, the state of Maryland publishes a 950 number that residents can call to obtain information from the state's registry of motor vehicles.

In addition, Citibank, N.A. publishes a 950-1492 number on its Citibank MasterCard statements that customers anywhere in the country can call for toll-free assistance. MCI Communications Corp. customers can dial 950-1022 to access MCI's network from public phones across the country.

Feature Group B was supposed to gradually disappear after divestiture ushered in equal access. The equal access ruling mandated that local exchange carriers upgrade their central office switches to provide 1 + dialing to all long-distance carriers, eliminating the need for users to dial special access numbers.

But to the surprise of many, the technology has not disappeared. Rather, it seems to be gaining in popularity to the point where the country is in danger of exhausting its supply of available numbers (see "Feature Group B numbers running out," page 18).

By far, the greatest number of users of 950 numbers are still carriers and third-party network providers. Carriers often use Feature Group B to originate and terminate calls on the local network because that is how they built their networks before equal access was widely available. In addition, Feature Group B access is slightly less expensive in some areas than equal access, also known as Feature Group D.

(continued on page 18)

Users test toll-free net access options

continued from page 17

Most value-added network providers, particularly those that offer transaction processing services, use Feature Group B because it has quicker response times and costs less than 800 services.

Sears is one of the largest users of 950 access outside of the three major long-distance carriers, according to Gary Weis, senior vice-president of networking and technology services at Sears Technology Services, Inc. (STS).

Weis said STS customers use Feature Group B in 160 LATAs — or about 90% of the U.S. — to access Sears' nationwide IBM Systems Network Architecture net. This means STS has a network node in each of the 160 LATAs, and all of those nodes are linked to a local exchange carrier using Feature Group B trunks. For the 40 LATAs in which STS doesn't have a net node, users dial an 800 number to access the network.

Sears decided to implement 950 access to its network in 1987 because the offering was half as expensive as providing switched access via an 800 number, according to Weis. In addition, the call setup times for 950 access tend to be several seconds faster because the local exchange carriers send the calls directly to the subscriber's network without processing Signaling System 7 data.

Internally, Sears will soon enable employees with portable 3270 terminals to dial a 950 number in order to access applications on the company's SNA network. Currently, employees use an 800 number to access the network, Weis said.

Pizza delivery

While Sears uses Feature Group B primarily to achieve greater cost savings and faster response times, Domino's decided to implement 950 access strictly for marketing purposes.

"Our market research showed that customers want to dial a local number when ordering pizza, not a long-distance 800 number," said Dan Gonos, the Domino's telecommunications manager who came up with the idea of using a nationwide 950 telephone number.

Gonos took his idea to AT&T, which helped develop the pizza ordering service using Feature Group B ("Domino's delivers using new call routing service," *NW*, Aug. 12, 1991).

Unlike Sears, Domino's uses Feature Group B to provide access to AT&T's network rather than its own. When callers dial 950-1430, they are connected to a dedicated processor within the nearest AT&T switching office.

The processor uses the ANI capability provided by Feature Group B to search a Domino's database in order to determine the caller's location. Once a match is made, the processor switches the call to the store closest to the caller.

"The 950 number gives us a local feel that will benefit our business," Gonos said. "We felt that an 800 number would conjure up images of some large telemarketing center in the middle of the country." ◻

Feature Group B numbers running out

Corporate America's growing appetite for Feature Group B access numbers is causing a problem for the North American Numbering Plan Administration (NANPA), which is scrambling to add new numbers before demand outstrips supply.

NANPA, which assigns and manages 800 and 900 numbers, area codes and Signaling System 7 point codes, among other things, has been on a crash course to expand the number of Feature Group B (950 exchange) access numbers from 1,000 to 10,000 by 1993.

Jim Deak, a staff member at NANPA in Livingston, N.J., said that all available Feature Group B numbers will be exhausted by early 1993. There are fewer than 200 numbers currently available and, on average, 11 new numbers are reserved each month.

To avoid a shortage of numbers, Deak and other staffers at NANPA have devised a two-pronged strategy.

First, Deak has been reclaiming unused or underused codes from subscribers, many of whom have accumulated more than three numbers through mergers and acquisitions. NANPA, which monitors usage of the codes, has reclaimed 160 of them since August of 1990. The second and most difficult part of the strategy involves expanding the total base of numbers to 10,000. This is expected to be accomplished by assigning users four-digit access codes instead of three-digit codes. Currently, all Feature Group B codes use 1 as the first digit after the 950 exchange prefix.

NANPA has been negotiating with the local exchange carriers to achieve this since the mid-1980s. According to Deak, the carriers have agreed to support an additional 9,000 numbers by early 1993, just when the supply of numbers is expected to be exhausted.

The carriers have been reluctant to support the new numbering plan because of the expense involved in reprogramming their switches, Deak said.

— *Wayne Eckerson*

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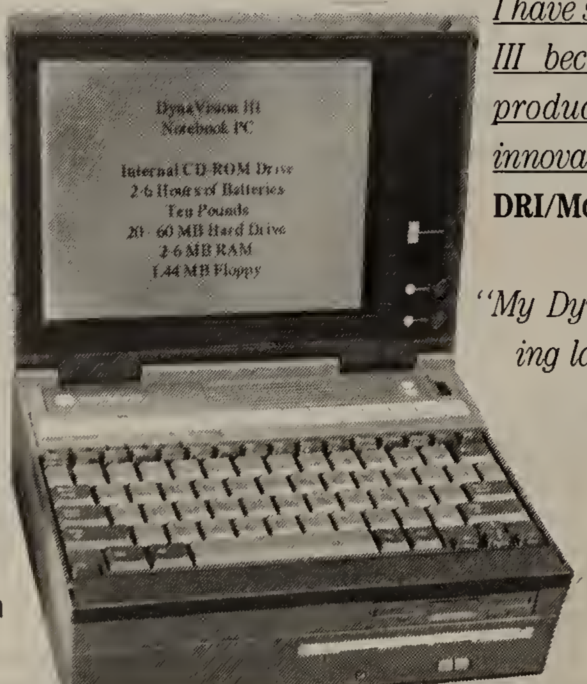

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GLOBAL NETWORKS

USER STRATEGIES, INTERNATIONAL SERVICES & REGULATION

Worth Noting

Multinational firms last year spent about $404 million on international digital private-line services to the U.S. Expenditures should increase to about $685 million in 1994, according to MarTech Strategies, Inc., a market research firm in Indialantic, Fla.

World News

As expected, the French government recently issued **Alpha Lyracom Space Communications, Inc.** of Greenwich, Conn., a license to provide private two-way very small aperture terminal satellite services in France.

Alpha Lyracom, which uses its own satellite to provide network services to Europe as well as North, Central and South America, was one of three private firms granted VSAT licenses by the French government.

The other companies were British Aerospace PLC and British Telecommunications PLC.

According to Alpha Lyracom, the license will enable it to build private VSAT networks that carry data, video and voice traffic, as well as route a limited amount of traffic between private VSAT networks and the public switched telephone network.

Japan's Ministry of Posts and Telecommunications recently approved an application by **Syncordia Corp.**, an Atlanta-based unit of British Telecommunications PLC (BT), to provide services in Japan.

BT formed Syncordia last fall to provide global private net services to multinational corporations.

BT is trying to persuade Germany's Deutsche Bundespost Telekom and Japan's Nippon Telegraph and Telephone Corp. to join the venture.

France Telecom revamps tariffs to align costs, prices

Carrier to end long-standing policy of subsidizing local-loop services with long-distance revenues.

By Barton Crockett
Senior Editor

PARIS — France Telecom last week launched a major program for revamping domestic private-line tariffs with the goal of reducing the average customer's private-line bills by 50% in three years.

France Telecom took its first step toward this goal on Jan. 1 by reducing tariffs as much as 17% for digital private lines longer than 300 km.

Meanwhile, the carrier hiked prices for some private lines shorter than 1 km by as much as 15% and raised installation fees for all private lines by an average of 60%.

France Telecom's goal is to make private-line tariffs more closely reflect actual provisioning costs. What this means is that the carrier is ending its long-standing policy of subsidizing local services with long-distance revenue.

"The new policy is to align service prices to the actual cost of the network and to drop dramatically over the next three years our pricing for digital leased lines," said Jacques Demael, marketing division head of France Telecom's domestic private-line services here.

> "The new policy is to align service prices to the actual cost of the network and to drop dramatically our pricing for digital leased lines."

▲▲▲

France Telecom changed the pricing of nearly all its domestic private-line services. For example, the carrier cut the price of 1.92M bit/sec private lines longer than 300 km by 15%, from 154,606 francs ($29,824 U.S.) per month to 131,416 francs ($25,350 U.S.) per month.

In addition, France Telecom hiked monthly tariffs for 1.92M bit/sec private lines shorter than 1 km by 15%, from 4,510 francs ($870 U.S.) to 5,187 francs ($1,000 U.S.).

France Telecom trimmed prices for 64K bit/sec private lines longer than 300 km by 17%, from 29,960 francs ($5,780 U.S.) to 24,867 francs ($4,797 U.S.).

Also, the carrier reduced monthly tariffs for 9.6K bit/sec private lines longer than 300 km by 12%, from 11,194 francs ($2,159 U.S.) to 9,850 francs ($1,900 U.S.) per month.

France Telecom reduced the price of two-wire analog leased lines longer than 300 km by 7%, from 10,570 francs ($2,039 U.S.) to 9,830 francs ($1,896 U.S.) per month. However, the carrier increased monthly charges for analog leased lines shorter than 1 km by 13%, from 290 francs ($56 U.S.) to 327 francs ($63 U.S.) per month.

> The carrier will pay users 5% of a private line's monthly tariff for each day beyond seven days the carrier is late delivering a private line.

▲▲▲

Along with the new tariffs, France Telecom implemented new service delivery and repair gaurantees. The carrier now will pay users 5% of a private line's monthly tariff for each day beyond seven days that the carrier is late delivering a private line.

Penalties cannot exceed four months of private-line rental payments.

In addition, France Telecom will pay users 1½ times the monthly tariff of a private line for each time it takes longer than 24 hours to repair an outage on a digital private line running at 48K bit/sec or faster.

The carrier will pay the same penalty for repair delays longer than 48 hours on analog private lines and digital private lines slower than 48K bit/sec.

According to Demael, France Telecom plans to change its tariffs again on Jan. 1, 1993.

Eventually, the carrier plans to make analog private-line prices equal to 64K bit/sec private-line prices by slashing the cost of 64K bit/sec private lines and slightly increasing rates for analog private lines.

UPS Telecom international service rates

Private-line capacity (bit/sec)	Monthly charge for U.S. half of private line to Germany or U.K.*	Onetime installation charge
64K	$2,300	$1,700
128K	4,100	1,700
192K	5,600	1,700
256K	7,000	1,700
384K	8,200	1,700
512K	10,200	1,700
768K	13,600	1,700
1.024M	17,000	1,700
1.544M	20,400	1,700

*Rates for point-to-point, fiber-optic or satellite private lines leased for a minimum of 1 year.

SOURCE: FEDERAL COMMUNICATIONS COMMISSION, WASHINGTON, D.C., AND UPS TELECOMMUNICATIONS, INC., MAHWAH, N.J.

GRAPHIC BY TERRI MITCHELL

UPS Telecom enters int'l resale market

New net services unit files first tariffs with FCC to offer private-line service to Germany, the U.K.

By Barton Crockett
Senior Editor

MAHWAH, N.J. — UPS Telecommunications, Inc. has become one of the first users to enter the fledgling international resale market with its recent filing with the Federal Communications Commission for international private-line service to Germany and the U.K.

The newly formed network services unit of United Parcel Service of America, Inc. (UPS), based here, is marketing private lines that are provisioned via its own global private network (see graphic, this page).

UPS Telecom is taking advantage of recent moves by Germany and the U.K. to lessen restrictions on international private-line resale. Carrier officials claim that their position as a reseller will enable them to offer better service than existing providers because it will let them provision end-to-end international private lines.

Currently, most carriers only offer the U.S. half of an international private line. Users typically have to obtain the foreign portion from a foreign carrier. Resellers bypass this situation by subleasing bandwidth from private lines leased from foreign carriers.

UPS Telecom will market services primarily to customers of its parent company, although any user could contract with the service provider ("UPS spin-off reveals int'l net strategy," *NW*, Sept. 2, 1991).

UPS Telecom is close to signing its first customer, according to company officials. But even though the unit is just getting off the ground, it is considering changing its focus.

Initially, UPS Telecom planned to focus primarily on international private-line services, according to Laynglyn Capers, the unit's manager of network services. But now it is considering providing international public switched telephone services via UPS' global private network.

"I think it's a potentially large market that other people, including UPS Telecom, would be interested in entering," Capers said.

There are several customers that are interested in obtaining international switched services from UPS Telecom, according to Capers. The company could provide these services by routing voice traffic into the public network from one or both ends of an international private line, he explained.

Capers said he believes UPS Telecom could charge substantially less for international switched services than carriers currently assess. UPS Telecom could undercut current prices because most carriers charge more for international calls than it would cost to carry the switched traffic over international private lines.

Savings would be greatest for calls from abroad to the U.S. because foreign carriers offer fewer discounts than U.S. carriers, Capers explained.

But UPS Telecom has not yet decided to move ahead, partly because nearly all countries, including Germany and the U.K., restrict the provision of international switched services via international private lines. FCC officials say they will only allow companies to resell switched services via international private lines if the foreign country also allows the practice.

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PRODUCTS & SERVICES

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First Look

DEC introduces new line of X Window terminals

Digital Equipment Corp. recently unveiled a new line of X Window terminals along with a server for extending the terminals' functionality.

The **VXT 2000 Window Terminal** family comprises seven members, all supporting resolutions of 100 dots per inch and a flicker-free refresh rate of 72 Hz. Models are available in color, gray scale and monochrome, and come standard with 4M bytes of memory, expandable to 16M bytes.

DEC also unveiled the **InfoServer 150VXT System,** a device that acts as a server for the X terminals. It provides configuration management, localized storage of fonts and a virtual memory capability that eliminates interruption when running applications.

Pricing for the VXT 2000 family ranges from $1,999 for a 15-in. monochrome model to $5,895 for a 19-in. color model. Terminal software, including X server software and DEC terminal-emulation software, is priced at $89 per terminal. The InfoServer is priced starting at $6,300 for support of 20 terminals. In non-InfoServer configurations, site boot software and documentation costs $499.

Digital Equipment Corp., Maynard, Mass. 01754; (508) 635-8290.

ISICAD links Command system to HP's OpenView

ISICAD, Inc. recently announced a software module that provides a link between its Command physical network management product and Hewlett-Packard Co.'s OpenView integrated net management system.

The module allows OpenView users to integrate information from Command's database of physical net information. It provides a real-time correlation between Command's database and OpenView's net data, which speeds problem resolution.

The new module is expected to be available by the end of 1992 and is priced at $2,500.

ISICAD, Inc., 1920 W. Corporate Way, P.O. Box 61022, Anaheim, Calif. 92803; (714) 533-8910.

Spider's LAN analyzer gets power boost

By Joanne Cummings
Staff Writer

BURLINGTON, Mass. — Spider Systems, Inc. recently unveiled a more powerful version of its SpiderProbe remote LAN analyzer that can capture twice as many data packets as the previous model.

The company's SpiderProbe B230 for Ethernet local-area networks acts as a slave analyzer, collecting data on local conditions at a remote LAN and forwarding it to a centrally located SpiderAnalyzer at a data center.

The new unit is a rack-mountable device based on an Intel Corp. 80386 microprocesor and can capture up to 8K packet/sec. Spider Systems' SpiderProbe B130 model could only handle half as many data packets.

The B230 comes with a single IEEE 802.3 Ethernet interface and one serial port.

The B230, like its predecessor, provides a full range of monitoring and analysis features, including detailed traffic and error statistics, networkwide and individual station alarms, traffic generation, hardware test facilities, packet capture and protocol decoding. The device communicates with the SpiderAnalyzer using a proprietary protocol over an Ethernet via bridges and Internet Protocol routers or over an RS-232 link.

It can decode most popular LAN protocols, including Digital Equipment Corp.'s DECnet and Local Area Transport, Novell, Inc.'s Internetwork Packet Exchange/Sequenced Packet Exchange (IPX/SPX), the Transmission Control Protocol/IP, Network File System, Apple Computer, Inc.'s AppleTalk, Network Basic I/O System and Server Message Block.

In addition, the B230 contains a removable programmable read-only memory (PROM) that can be replaced with another PROM that features new software upgrades.

Future upgrades will include support for the Simple Network Management Protocol RMON Management Information Base when that specification becomes available.

The SpiderProbe B230 will replace the Ethernet version of the B130.

Available now, the SpiderProbe B230 is priced the same as the B130. It comes in two models, one of which costs $4,200 and can decode protocols up to Layer 4 of the Open Systems Interconnection model. The other model, which is priced at $4,950, can decode protocols up to Layer 7 of the OSI model.

For more information, contact Spider Systems at 12 New England Executive Park, Burlington, Mass. 01803, or call (617) 270-3510.

MCC card links AppleTalk LANs to frame relay nets

SANTA BARBARA, Calif. — Multiaccess Computing Corp. (MCC) recently announced an adapter card that links Apple Computer, Inc. Macintoshes on AppleTalk LANs directly to public frame relay services.

The MCC-1000F NuBus card fits into a NuBus slot of a Macintosh II designated as a server on an AppleTalk local-area network. It enables LAN-attached users to communicate directly with the frame relay network without a separate data service unit/channel service unit (DSU/CSU) or connection to a wide-area network router, said William Snook, software engineer at MCC.

The MCC-1000F supports ANSI T1.617 and T1.618 frame relay standards and can link to public frame relay services from carriers such as AT&T, MCI Communications Corp., Pacific Bell, US Sprint Communications Co. and WilTel. The card contains its own DSU/CSU and is designed to link to services running over T-1 or fractional T-1 lines.

Snook said the card is well suited to companies that need to link just two AppleTalk LANs via frame relay services. It provides a direct connection to the WAN, obviating the need for a bridge or router to link to the frame relay service.

Snook said the card will provide an easy migration path to users moving to Switched Multimegabit Data Services because it would only involve a software change. He said pricing for the upgrade has not been set.

The MCC-1000F has one port for a standard D15 connection. It is priced at $2,995 and is expected to be available by the end of February.

For more information, contact MCC at 5350 Hollister Ave., Bldg. C, Santa Barbara, Calif. 93111, or call (805) 946-2332.

Software links Macs to DEC VAXes, Unix

White Pine's new software line is first VT-300 emulator to provide color and graphics support.

By Joanne Cummings
Staff Writer

NASHUA, N.H. — White Pine Software, Inc. recently unveiled a new line of software that enables Apple Computer, Inc. Macintoshes to emulate Digital Equipment Corp. VT-300 terminals.

The software enables any Macintosh to communicate with DEC VAX or Unix computers, and it is the first VT-300 emulator to provide graphics and color support, the company said.

The software comes in three versions. The Mac320 provides both color and monochrome VT-320 text-only emulation. Traditional VT-320 terminals only provide monochrome support.

The Mac330 provides DEC VT-330 emulation with monochrome graphics and color text.

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The Mac330 provides DEC VT-330 emulation with monochrome graphics and color text capabilities, and the Mac340, a VT-340 terminal emulator, provides the same features as the Mac330 but with added color capabilities for graphics.

DEC's VT-330 Plus terminal supports text and graphics but has only monochrome capability, while its VT-340 Plus supports color text and graphics, according to DEC.

DEC also offers Macintosh VT-300 terminal-emulation software called Pathworks for Macintosh. Designed for Macintoshes on DECnet networks, this $295 software enables Macintoshes to emulate DEC VT-320 text-only terminals but provides just monochrome support. DEC does not currently offer VT-330 Plus or VT-340 Plus emulation for the Macintosh.

All of White Pine's emulators support DEC's VT-52, VT-100, VT-200 and VT-300 terminal modes.

In addition, the Mac330 and Mac340 also support Tektronix, Inc.'s terminal mode.

While traditional DEC VT-300 terminals limit users to just two sessions on a maximum of two hosts, White Pine's emulators enable users to open multiple sessions on multiple hosts. The only limitation is available system memory, the company said.

In addition, the new emulators enable users to save session files, which include host connection information and setup parameters, for quick access at a later time.

To activate a saved session file, users double-click on the file icon or open the file from within the terminal-emulation application.

This feature eases communications with different hosts because users can store various host setups within different session files and access the hosts simply by opening the files.

Emulator support

For network connections, the emulators support MacTCP for Transmission Control Protocol/Internet Protocol and Telnet connections, as well as Apple's Communication Toolbox for DECnet or Local Area Transport (LAT) connections.

Each terminal-emulation package comes with all the software necessary for making LAT, TCP/IP, direct, serial or modem connections.

All of White Pine's emulators support DEC's VT-52, VT-100, VT-200 and VT-300.

▲▲▲

The emulators also offer file-transfer features including a character-transfer feature for simple text file transfers and a protocol file-transfer feature for more complex files.

The emulators support Xmodem, Ymodem, Kermit and the File Transfer Protocol.

The emulators are available now. The Mac320 costs $149, the Mac330 costs $249, and the Mac340 is priced at $349.

For more information, contact White Pines at 40 Simon St., Nashua, N.H. 03060, or call (603) 886-9050.

PEER-TO-PEER NETWORKING

BY DOUGLAS WELCH

File sharing can be a security nightmare

Peer-to-peer networking, once considered a victim of client/server computing's popularity, hasn't died; it has simply mutated into something else.

For example, it seems as if every operating system these days has some new, built-in, peer-to-peer-like network features that make it easier for users to share data, such as Apple Computer, Inc.'s System 7.0 file sharing and Microsoft Corp.'s expansion of the Dynamic Data Exchange, known as Windows NetDDE.

Unfortunately, peer-to-peer networking in whatever form, be it Sitka Corp.'s TOPS or Apple's File Sharing and AppleEvents, can lead to some serious holes in network security. Unless users are aware of the dangers of free-flow file sharing, we could see a major increase in computer trespassing. How can the necessity of easy file sharing be balanced against the need for centralized security and control?

File sharing, by its very nature, is simple to set up. But unfortunately, that same ease of use usually translates into poor security. Users can give up all rights to part or all of their hard drive. With the touch of a few buttons, confidential data is left vulnerable, critical programs are exposed to tampering and software piracy is made even easier. Without some basic management, this could quickly turn into a network manager's worst nightmare.

Methods to secure file sharing

There are several ways to combat these problems without removing the most useful qualities of peer-to-peer networking. First is to have informed end users who understand exactly what is at stake if network security is breached. It is essential that users understand the loss of time, money and prestige that could result from a security breach.

End users must also understand what makes a network secure and how they can best protect themselves and others. The network group should assist users by producing documentation that prepares users for their new security responsibilities.

Second, network managers must perform regular spot checks to ensure that guidelines are being followed. There is no better test than an electronic stroll through the network. A few minutes spent "turning account doorknobs" can be a useful way to find those users who don't yet have their security buttoned down.

For example, net managers should check for obvious passwords, such as a person's name, company name or other easily guessed password. Some users may also unknowingly set up guest accounts with full privileges. These types of errors show there are education problems that must be addressed by net managers.

Finally, all requests to share data should pass through the network group. This will ensure that security procedures are being followed from the beginning. It will also ensure that only those needing access to the data are included.

Once this setup is complete, it will allow users to control access to shared directories and programs on an as-needed basis without assistance from the network group. Net managers can then devote their time to larger issues, confident that users have the knowledge, tools and ability to manage their own security. Also, making users responsible will force them to take security seriously.

With all the advances being made in built-in peer-to-peer networking features, network managers must enlist the aid of users in managing this distributed resource by educating and involving them in keeping the network and their data secure. ◼

Welch is a support analyst for a major entertainment corporation in Los Angeles.

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EDITORIAL

Some New Year's resolutions for network executives

It's time to make resolutions, both personal and professional, for this year. While we won't intrude on your personal resolutions, we humbly offer some professional ones that network executives may want to embrace during 1992.

◼ Make 1992 the year you draft and begin implementing a long-term, strategic open network plan that will free your company from the shackles of proprietary systems.

What's long term these days? That depends on your company's needs. But we think a strategic plan should look at least three to five years into the future and set major milestones for achieving an open network. Implementing X.400 gateways is just one example.

What's open? Purists will be debating that issue well into the future. But we think it's more important that you map out how to build an infrastructure that lets employees companywide share information and applications than for you to worry about whether to implement Transmission Control Protocol/Internet Protocol or work toward a pure Open Systems Interconnection environment.

The point is that you can't get from where you are today to the open architecture of the future without a road map. Put off drawing that map and your competitors may well be racing ahead.

◼ Make 1992 the year you broaden your technical horizons. It's a tough job market today with all the cutbacks, layoffs and corporate downsizings. In order to ensure your marketability as a network professional, you have to keep expanding your skills.

Keep this in mind, even if you're in a hot job area today. Some technologies that were popular five years ago have now cooled considerably, and your specialty may cool just as quickly. Make education and new technical skills your safety net in a down economy, and encourage your staff to do the same.

◼ Make 1992 the year you learn more about the business your network supports. The best technical skills and the smartest staff won't mean much if you don't understand the needs, challenges and problems of the people who rely on your net.

Get out and about within your company. Find out more about what's going on within the industry and what your organization's strategic goals are. There are many technology gurus who can put a network in place, but it takes real insight and understanding to apply technology to solve business problems.

Keeping these resolutions could make 1992 — and the years ahead — more successful and rewarding for both you and your company. ◼

OPINIONS

BROADBAND NETWORKS

BY ART BARBER

Gov't could revolutionize industry by buying services

As 1991 drew to a close, President Bush signed into law Sen. Al Gore's (D-Tenn.) High-Performance Computing Act of 1991, which makes about $2 billion in government funds available in the next five years for development of a communications superhighway. Unfortunately, there is a danger that this program will be an industrial Vietnam — a program with resources but no agreed-on goals.

Unlike the U.S., Japan has a national program to provide fiber to the home by the year 2015, with the goal of providing products and services that both residential and business users will buy. In contrast, the primary objective of the U.S. program is research, such as connecting university supercomputers — a limited market when compared with switched broadband service, videoconferencing, and graphic and multimedia transmissions.

The Gore bill, which was sold to Congress and the public as a means to achieve U.S. technological superiority, does not consider market demand. Creative government communications managers are discouraged from investing time and effort in programs that could have a commercial application.

In the 1960s, the Defense Advanced Research Projects Agency (DARPA) developed the Advanced Research Projects Agency Network (ARPANET), a nationwide data net. Today, ARPANET has become the Internet, an efficient international data network serving thousands of locations worldwide and the product of a program that assisted in the development of services benefitting communications users.

How times have changed. During the past year, Craig Fields, DARPA director, was fired for funding defense projects that could serve not only the Department of Defense, but also many other world markets.

Unlike the 1960s, the government today is not spending communications money in ways that will help develop better communications services. For example, Federal Telecommunications System (FTS) 2000, sold to Congress as a way to save money, spends billions of tax dollars annually and does little or nothing to stimulate better communications.

To the contrary, the 10-year contract stifles creative services that have emerged since the contract was signed. In addition, the General Accounting Office recently reported that in the next two years, federal agencies will pay $176 million more through FTS 2000 than if the government ordered service from suppliers at existing public rates.

If the U.S. had an industrial policy that encouraged the communications industry to offer inexpensive, useful services and applications, U.S. government spending for services such as FTS 2000 and those stipulated in the Gore bill would be used to assist the communications industry in maintaining a position of world leadership.

Like the U.S. commitment to Vietnam, the Gore bill creates a large centralized program in which a few players make decisions without any clear agreement on goals. As with Vietnam, Congress has simply given the president a blank check to assign funds and responsibilities.

All the equipment necessary to build an economical high-performance national broadband network exists. The telecommunications carriers know how to build broadband networks to provide voice, data and video, including interactive programs. The problem is they don't know what the demand will be.

Few are willing to risk hundreds of millions of dollars to create a network until they are confident that they will have customers. If the government was to purchase services such as new economical videoconferencing services, they could accelerate the growth of the videoconferencing market. Switched broadband data service and similar new services would benefit greatly from some early, limited government purchases.

In the 1950s and '60s, the government laid the foundations for U.S. leadership in jet aircraft and mainframe computers. When the commercial jet aircraft market was still unproven, the government placed a large order with The Boeing Co. for the KC-135, a modified 707. The 707 went into mass production, and as a result, Boeing gained a world leadership role that it still maintains.

In the 1950s, the Census Bureau, the National Security Agency and the Defense Department purchased many of the first mainframes. It was only after successful government operation that banks, insurance companies and other private businesses purchased their first large computers, giving U.S. computer companies a world leadership role.

Why not follow the pattern of the 707 and the computer industry by having the government be the first purchaser of broadband network services? The government shouldn't spend billions of dollars building a superhighway designed to serve only supercomputer centers; the superhighway should serve all that want to use it.

Passage of the Gore bill shows that the federal government is willing to invest billions of dollars in the development of broadband networks. Let's hope that goals and responsibilities are wisely chosen and responsive to user demand so the U.S. communications industry can become the undisputed world leader in broadband networking. Our goal must be to develop economical local and national broadband nets that provide useful services to communications users here and abroad. ◪

Barber is president of Bethesda, Md.-based PrivateNet, which designs and installs custom private networks.

ATTENTION LAN E-MAIL VENDORS: *Network World* would like to list your product in a Buyer's Guide on March 2. We'll include electronic mail packages for local-area networks as well as gateway products that link LAN E-mail packages to enterprise messaging systems, E-mail services or X.400 networks.

To obtain a survey form, call Jim Brown, managing editor of features, at (508) 875-6400 or Dan Blum of Rapport Communication, a Takoma Park, Md.-based consultancy, at (301) 270-6405.

TELETOONS

BY FRANK AND TROISE

Yeah.. he is kind of weird but he's the only one who actually applied for the job of maintaining the LAN wiring closet.
WIRING CLOSET

LETTERS

AT&T unit remains

To prevent misinterpretation of the Nov. 18, 1991 *Network World* brief "AT&T Paradyne announces layoffs," it would be advantageous for your readers to review the following clarifications:

- AT&T Paradyne is, and will continue to be, a wholly owned subsidiary and business unit of AT&T. There are no consolidation plans with any other AT&T business unit.
- The lessening of our analog modem business is due to customers' migration to our digital products.

Garrick Case
Media relations manager
AT&T Paradyne
Largo, Fla.

TRT/FTC standing tall

I read your Dec. 9, 1991 article ("Cable & Wireless bails out of deal to acquire TRT/FTC") pertaining to the recently announced termination of our agreement with Cable & Wireless PLC for the acquisition of TRT/FTC Communications, Inc. Although both parties were disappointed that the transaction was unable to be consummated, this does not affect the viability of TRT/FTC or the commitment of Pacific Telecom, Inc. to fully support TRT/FTC as the company continues to pursue its strategic goals. Pacific Telecom believes the viability and value of TRT/FTC should remain high. We will be exploring possible strategic alliances with other major domestic and international telecommunications firms as part of our efforts to assist TRT/FTC in its future growth.

Theodore Berns
President and chief
operating officer
Pacific Telecom, Inc.
Vancouver, Wash.

Network World *welcomes letters from its readers.*

Letters should be typed and double-spaced. Mail them to Editor, Network World, *161 Worcester Road, Framingham, Mass. 01701.*

Letters may be edited for space and clarity.

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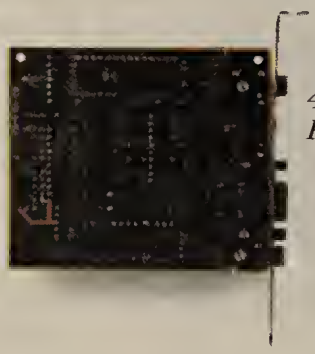
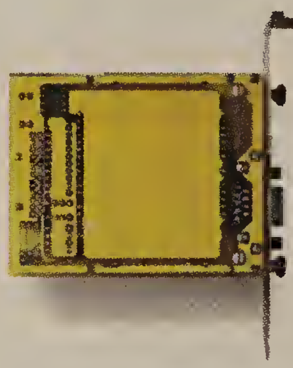
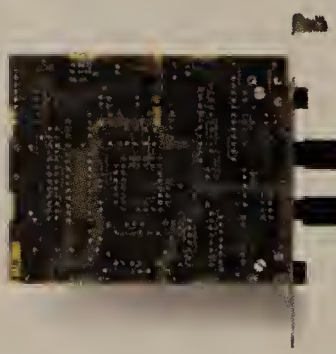


4 Mbps Twisted Pair RIM



4/16 Mbps Selectable Twisted Pair RIM



4/16 Mbps Selectable Fiber Optic RIM

If you want to change your network from 4 to 16 Mbps or from twisted pair to fiber optic, you simply snap on a new RIM (Ring Interface Module). IRMAtrac is the industry's only field-upgradeable board!

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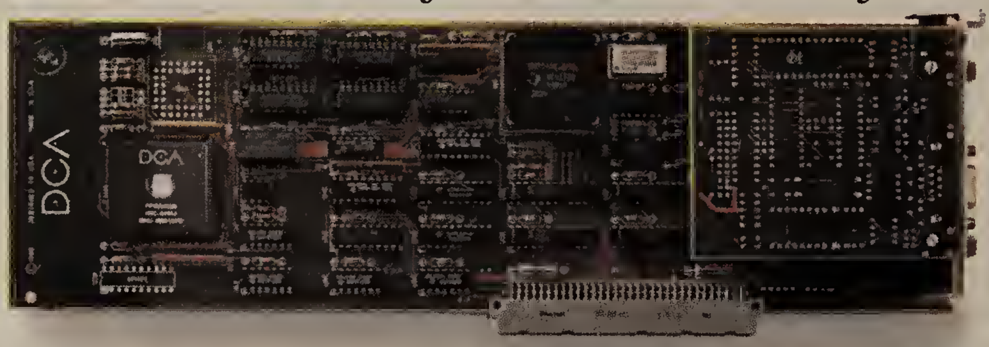

MacIRMAtrac™ token-ring adapter is also engineered to use the same, three, field-upgradeable RIMs. So again, if new standards emerge or your needs change, you won't have to change boards, just RIMs.

Presenting the world's most flexible token-ring adapters: IRMAtrac & MacIRMAtrac. They let you change your PC architecture, your cabling, your transmission speed and your mind–all without having to buy a new board!

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16M BIT/SEC

TOKEN-RING

NETWORKS

Token ring gets up to speed

CONTINUED FROM PAGE 1

sec and are using the 4M bit/sec speed until the greater speed is needed.

When large numbers of LANs must be interconnected, many users are turning to the Fiber Distributed Data Interface for their backbone ("FDDI gains acceptance as backbone option of choice," *NW,* Dec. 16, 1991). "Leading-edge users who are into backbones are looking at FDDI," says Lee Doyle, director of LAN research at International Data Corp. (IDC), a Framingham, Mass.-based research firm.

The most common types of token ring-compatible devices are adapter cards, hubs, multistation access units (MAU), bridges and routers. This Buyer's Guide covers cards, hubs and MAUs and includes comparison charts. Buyer's Guides on bridges and routers supporting token-ring and other LANs will run later in 1992.

(continued on page 29)

Hurwicz is a free-lance writer and local-area network consultant based in Nashville.

CHART • GUIDE

Buyer's Guide charts comparing token-ring adapter cards begin on page 26, while charts examining 16M bit/sec token-ring MAUs and 16M bit/sec token-ring hubs begin on pages 29 and 30, respectively.

After clearing technical hurdles, 16M bit/sec token ring delivers on speed promise.

Token-ring adapters

Company	Product	Card size	Bus	Cabling	Network operating system drivers	I/O architecture	On-board RAM	Diagnostics	Management from same vendor	Other features	Price/ warranty
Accton Technology Corp. Fremont, Calif. (800) 926-9288	RingPocket	NA	Parallel port	STP and UTP	Novell, Inc.'s NetWare 2.X and 3.X, IBM LAN Support Program, 3Com Corp.'s 3+Open, IBM's LAN Manager, Accton LANSoft, Banyan Systems, Inc.'s VINES 4.10 and Microsoft Corp's NDIS	I/O mapped	128K bytes	LED for 4M/16M bit/sec status and installation diagnostic software	None	None	$779/2 years
	RingPair 4/16	Half	ISA, 8 or 16 bit	STP and UTP	NetWare 2.X and 3.X, IBM PC LAN Program, Personal Communications/ 3270, AS/400 PC Support Program, 3+Open, LAN Manager and LANSoft	DMA, with burst mode	128K bytes	Diagnostic software and link status LED	None	None	$829/lifetime
	RingPair MC 4/16	Full	MCA, 16 bit	STP and UTP	NetWare 2.X and 3.X, PC LAN Program, Personal Communications/ 3270, AS/400 PC Support Program, 3+Open, LAN Manager, LANSoft	DMA, with burst mode	128K bytes	Diagnostic software and link status LED	None	None	$829/lifetime
Andrew Corp. Torrance, Calif. (800) 733-0331	Token Ring Adapter Card 4/16 PC	Half	ISA, 8 bit	STP and UTP	3+Open,LAN Manager, OS/2 LAN Server, NetWare 2.X and 3.X and PC LAN Program	Shared memory	128K bytes	Diagnostic software	MAUi 8700 Media Management Program	None	$795/1 year
	Token Ring Adapter Card 4/16 AT	Full	ISA, 16 bit	STP and UTP	3+Open, LAN Manager, OS/2 LAN Server, NetWare 2.X and 3.X and PC LAN Program	DMA	128K or 512K bytes	Diagnostic software	MAUi 8700 Media Management Program	Bus mastering	$845 ($95 for 512K-byte option)/1 year
	Token Ring Adapter 4/16 ISA	Half	ISA, 8 or 16 bit	STP and UTP	3+Open, LAN Manager, OS/2 LAN Server, NetWare 2.X and 3.X, PC LAN Program, SCO Unix and AT&T Unix	DMA	128K bytes	Diagnostic software	MAUi 8700 Media Management Program	Bus mastering	$895/1 year
	Token Ring Adapter 4/16 MCA	Full	MCA, 16 bit	STP and UTP	3+Open, LAN Manager, OS/2 LAN Server, NetWare 2.X and 3.X, PC LAN Program, SCO Unix and AT&T Unix	DMA	128K bytes	Diagnostic software	MAUi 8700 Media Management Program	Bus mastering	$895/1 year
Asante h-three Systems Morrisville, N.C. (800) 622-7464	MacRing	Full	Apple Computer, Inc. Macintosh NuBus and direct slot	STP and UTP	Apple's AppleTalk Phase 2, NetWare 3.11, LAN Manager and VINES	DMA, with burst mode	128K bytes	Asante's MacRing Manager	None	Macintosh-to-IBM mainframe and minicomputer connectivity	$799/5 years
Avatar Corp. Santa Clara, Calif. (800) 874-3282	LanWay TR 16/4	Full	Macintosh NuBus, direct slot or LC, all 16 bit	STP	Apple's MacOS, NetWare 2.X and 3.X, 3+Open and NDIS	DMA	128K bytes	Network control panel	Network control panel	Bus mastering	$895/1 year
	LanWay TR 16/4	Full	MCA, EISA or ISA, all 16 bit	STP	MacOS, NetWare 2.X and 3.X, 3+Open and NDIS	DMA	128K bytes	None	None	Bus mastering	$795/1 year
CNet Technology, Inc. San Jose, Calif. (800) 486-2638	CN1000T	Two-thirds	ISA, 8 or 16 bit	STP	NetWare 2.X and 3.X, LAN Manager, LAN Server, 3+Open, FTP Software, Inc.'s PC/TCP, Sun Microsystems, Inc.'s PC/NFS, VINES and LAN Support Program	DMA	128K bytes	2 LEDs, 1 power and 1 network activity	None	Bus mastering	$699/5 years
	CN1000T/2	Full	MCA, 16 bit	STP	NetWare 2.X and 3.X, LAN Manager, LAN Server, 3+Open, PC/TCP, PC/NFS, VINES and LAN Support Program	DMA	128K bytes	2 LEDs, 1 power and 1 network activity	None	Bus mastering	$799/5 years
	CN50TR1	External adapter	NA	STP	NetWare 2.X and 3.X, LAN Manager, LAN Server, 3+Open, PC/TCP, PC/NFS, VINES and LAN Support Program	DMA	128K bytes	2 LEDs, 1 power and 1 network activity	None	Bus mastering	$799/1 year
	CN50TR3	External adapter	NA	UTP	NetWare 2.X and 3.X, LAN Manager, LAN Server, 3+Open, PC/TCP, PC/NFS, VINES and LAN Support Program	DMA	128K bytes	2 LEDs, 1 power and 1 network activity	None	Bus mastering	$799/1 year
Digital Communications Associates, Inc. Alpharetta, Ga. (800) 348-3221	IRMAtrac Token Ring Adapter/Convertible	Full	ISA, 8 or 16 bit, and MCA, 16 bit	STP or UTP at 4M bit/sec and STP only at 16M bit/sec	NetWare 2.X and 3.X, PC LAN Program, LAN Manager, 3+Open, VINES and IBM NETBIOS	DMA, with burst mode	128K bytes, upgradable to 2M bytes	Diagnostic software	None	One card with both MCA and ISA capability, bus mastering and removable ring interface module that allows easy field upgrade to new media	$895/1 year
	MacIRMAtrac	Full	NuBus	STP or UTP at 4M bit/sec, STP only at 16M bit/sec	AppleTalk	DMA, with burst mode	128K bytes, upgradable to 2M bytes	Diagnostic software	None	Bus mastering and removable ring interface module that allows easy field upgrade to new media	$895/1 year
	IRMAtrac 4/16 Fiber-Optic Token-Ring Adapter/Convertible	Full	ISA, 8 or 16 bit, and MCA, 16 bit	62.5/125, 50/125 or 100/140 micron multimode duplex fiber-optic cabling	NetWare 2.X and 3.X, PC LAN Program, LAN Manager, 3+Open, VINES and NETBIOS	DMA, with burst mode	128K bytes, upgradable to 2M bytes	Diagnostic software	None	One card with MCA and ISA capability, bus mastering and removable ring interface module that allows easy field upgrade to new media	$1,195/1 year
IBM Armonk, N.Y. (800) 426-3333	Token Ring 16/4 Adapter	Full	ISA, 16 bit	STP and UTP	NetWare 2.X and 3.X, PC LAN Program, LAN Server, OS/2 Extended Edition and AIX	DMA	64K bytes	Self-test at power-on	NetView and LAN Manager	None	$895/1 year

DMA = Direct memory addressing
EISA = Extended Industry Standard Architecture
ISA = Industry Standard Architecture
MAU = Multistation access unit
MCA = Micro Channel Architecture
NA = Not applicable

NDIS = Network Device Interface Specification
ODI = Open Datalink Interface
SCO = The Santa Cruz Operation, Inc.
SRA = Source Routing Accelerator
STP = Shielded twisted pair
UTP = Unshielded twisted pair

This chart includes a representative selection of token-ring adapters. These vendors may offer other adapters, and other vendors not included may offer a full range of products.

SOURCE: MICHAEL HURWICZ, EASTSOUND, WASH

Token-ring adapters (continued on page 28)

Company	Product	Card size	Bus	Cabling	Network operating system drivers	I/O architecture	On-board RAM	Diagnostics	Management from same vendor	Other features	Price/ warranty
IBM (cont.)	Token Ring Network16/4 Adapter/A	Full	MCA, 16 bit	STP and UTP	NetWare 2.X and 3.X, PC LAN Program, LAN Server, OS/2 Extended Edition and AIX	DMA	64K bytes	Self-test at power-on	NetView and LAN Manager	None	$895/1 year
	Token Ring Network 16/4 Busmaster Server Adapter/A	Full	MCA, 16 bit	STP and UTP	NetWare 2.X and 3.X, PC LAN Program, LAN Server, OS/2 Extended Edition and AIX	DMA, with burst mode	128K bytes	Self-test at power-on	NetView and LAN Manager	Bus mastering	$1,030/1 year
IQ Technologies, Inc. Bothell, Wash. (800) 227-2817	p-LAN 16/4 Token Ring Adapter	External	Parallel port	STP and UTP	3+Open, LAN Manager, LAN Server, NDIS, NetWare 2.X and 3.X, PC LAN Program, TCP/IP, VINES, PC-3270, AS/400, IBM LAN Support Program Adapter Handler Replacement Program	NA	64K bytes	2 LEDs, 1 for mode (printer or LAN) and 1 for network activity and computer card activity	None	Flexible interface cable, self-configuring driver and a pass-through parallel port	$995/2 years
Lantana Technology, Inc. San Diego (619) 565-6400	Cypress 1/16	Half	ISA, 8 bit	STP and UTP	NetWare 2.X and 3.X, ODI, LAN Manager, NDIS, PC LAN Program, TCP/IP (through 802.2 and 802.5) and NETBIOS	Mapped I/O or pseudo DMA	128K bytes	3 LEDs for faulty cabling, MAU problem, internal ring interface and diagnostic software	None	Software programmable, no jumpers or switches	$725/2 years
	Cypress 2/16	Full	MCA, 16 bit	STP and UTP	NetWare 2.X and 3.X and LAN Manager	DMA	128K bytes	3 LEDs for faulty cabling, MAU problem, internal ring interface and diagnostic software	None	Bus mastering, software programmable, no jumpers or switches	$795/2 years
	Cypress 3/16	Full	ISA, 16 bit	STP and UTP	NetWare 2.X and 3.X and LAN Manager	DMA, with burst mode	128K bytes	3 LEDs for faulty cabling, MAU problem, internal ring interface and diagnostic software	None	Bus mastering, software programmable, no jumpers or switches	$795/2 years
Madge Networks, Inc. San Jose, Calif. (800) 876-2343	Smart 16/4 PC Ringnode	Half	ISA, 8 bit	STP and UTP	NetWare 2.X and 3.X, NetWare Lite, VINES, PC LAN Program, 3+Open, LAN Server and Artisoft, Inc.'s LANtastic	Mapped I/O	128K bytes	Diagnostic software	Madge Ring Manager II	Drivers autoconfigure at installation, and clearly marked and diagrammed configuration switches	$795/5 years
	Smart 16/4 AT Ringnode	Full	ISA, 8 or 16 bit	STP and UTP	NetWare 2.X and 3.X, NetWare Lite, VINES, PC LAN Program, 3+Open, LAN Server and LANtastic	Mapped I/O or DMA, with burst mode	128K bytes	Diagnostic software	Madge Ring Manager II	Bus mastering, drivers autoconfigure at installation, and clearly marked and diagrammed configuration switches	$945/5 years
	Smart 16/4 EISA Ringnode	Full	EISA, 32 bit	STP	NetWare 2.X and 3.X, NetWare Lite, VINES, PC LAN Program, 3+Open, LAN Server and LANtastic	Mapped I/O or DMA, with burst mode	128K bytes	Diagnostic software	Madge Ring Manager	Bus mastering, drivers autoconfigure at installation and EISA configuration file for ring speed	$1,295/5 years
	Smart 16/4 MC Ringnode	Full	MCA, 32 bit	STP and UTP	NetWare 2.X and 3.X, NetWare Lite, VINES, PC LAN Program, 3+Open, LAN Server and LANtastic	Mapped I/O or DMA, with burst mode	128K bytes	Diagnostic software	Madge Ring Manager	Bus mastering, installed program determines optimal driver configuration and MCA configuration file for ring speed and cable type	$945/5 years
Megahertz Corp. Salt Lake City (801) 272-6000	T2TR16 External Token Ring LAN Adapter	Laptop proprietary	External 8-bit expansion bus	STP and UTP	NetWare 2.X and 3.X, PC LAN Program, LAN Server, LAN Manager and 3+Open	Mapped I/O	128K bytes	Diagnostic software	None	Self-configuring drivers	$999/5 years
	T2TR16 Internal Token Ring LAN Adapter	Laptop proprietary	Internal 8-bit laptop proprietary bus	STP and UTP	NetWare 2.X and 3.X, PC LAN Program, LAN Server, LAN Manager and 3+Open	Mapped I/O	128K bytes	Diagnostic software	None	Self-configuring drivers	$799/5 years
National Data Communications San Jose, Calif. (408) 428-9108	ND1107 4/16 Token-Ring Adapter	Half	ISA, 8 bit	STP and UTP	Same as IBM card	Shared memory	64K bytes	None	None	Uses IBM chip set	$495 for 1, $440 each in quantities of 10/18 months
	ND1104 4/16 Token-Ring Network Adapter	Three-fourths	ISA, 8 or 16 bit	STP and UTP	NetWare 2.X and 3.X, LAN Support Program, PC LAN, Data Link Control, NETBIOS, LAN Manager, VINES, IBM Emulation Software and TCP/IP	DMA, with burst mode	512K bytes	None	None	Bus mastering	$695 for 1, $618 each in quantities of 10/ 18 months

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MCA = Micro Channel Architecture
NA = Not applicable
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ODI = Open Datalink Interface
SCO = The Santa Cruz Operation, Inc.
SRA = Source Routing Accelerator
STP = Shielded twisted pair
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This chart includes a representative selection of token-ring adapters. These vendors may offer other adapters, and other vendors not included may offer a full range of products.

SOURCE: MICHAEL HURWICZ, EASTSOUND, WASH.

Token-ring adapters (continued from page 27)

Company	Product	Card size	Bus	Cabling	Network operating system drivers	I/O architecture	On-board RAM	Diagnostics	Management from same vendor	Other features	Price/ warranty
NCR Corp. **Network Products Division** **St. Paul, Minn.** **(612) 638-7447**	16/4 Token Ring Adapter/MC	Full	MCA, 16 bit	STP and UTP	NCR LAN Manager, PC LAN Program, NCR PC LAN, NetWare 2.X and 3.1X and Unix licensed separately	DMA, with burst mode	128K bytes	Diagnostic software	STAR Sentry	Bus mastering and configurable options eliminate conflicts with other adapters	$895/1 year
	16/4 Token Ring Adapter/ISA	Half	ISA, 16 bit	STP and UTP	NCR LAN Manager, PC LAN Program, NCR PC LAN and NetWare 2.X and 3.1X	DMA, with burst mode	128K bytes	Diagnostic software	STAR Sentry	Bus mastering and configurable options eliminate conflicts with other adapters	$895/1 year
Olicom U.S.A., Inc. **Richardson, Texas** **(214) 680-8131**	MC 16/4 Adapter	Full	MCA, 16 bit	STP and UTP	NetWare 2.X and 3.X, 3+Open, LAN Manager, LAN Server, OS/2 Extended Edition Communications Manager	DMA, with burst mode	128K bytes	Diagnostic software	None	Bus mastering	$895/3 years
	EISA 16/4 Adapter	Two-thirds	EISA, 32-bit	STP and UTP	NetWare 2.X and 3.X, 3+Open, LAN Manager, LAN Server, OS/2 Extended Edition Communications Manager	DMA, with burst mode	128K bytes	Diagnostic software	None	Bus mastering	$950/3 years
	ISA 16/4 Adapter	Two-thirds	ISA, 8 or 16 bit	STP and UTP	NetWare 2.X and 3.X, 3+Open, LAN Manager, LAN Server, OS/2 Extended Edition Communications Manager, SCO Unix and AT&T Unix	Mapped I/O or DMA, with burst mode	128K bytes	Diagnostic software	None	Bus mastering	$895/3 years
Proteon, Inc. **Westborough, Mass.** **(800) 545-7464**	ProNET 4/16 p1390 Token Ring Adapter	Full	ISA, 16 bit	STP and UTP	NetWare 2.X and 3.X, LAN Manager, LAN Server, NETBIOS, NDIS, ODI, Digital Equipment Corp.'s Pathworks, PC LAN Program, PC/TCP, SCO Unix and VINES	DMA	128K bytes	Diagnostic software	TokenView Plus	Bus mastering	$895/lifetime
	ProNET 4/16 p1990 Token Ring Adapter	Full	EISA, 32 bit	STP and UTP	NetWare 2.X and 3.X, LAN Manager, LAN Server, NETBIOS, NDIS, ODI, Pathworks, PC LAN Program, PC/TCP, SCO Unix and VINES	DMA, with burst mode	128K bytes	Diagnostic software	TokenView Plus	Bus mastering	$1,195/ lifetime
	ProNET 4/16 p1890 Token Ring Adapter	Full	MCA, 16 bit	STP and UTP	NetWare 2.X and 3.X, LAN Manager, LAN Server, NETBIOS, NDIS, ODI, Pathworks, PC LAN Program, PC/TCP, SCO Unix and VINES	DMA	128K bytes	Diagnostic software	TokenView Plus	Bus mastering	$750/lifetime
	ProNET 4/16 p1892 Token Ring Adapter	Full	MCA, 16 bit	STP and UTP	NetWare 2.X and 3.X, LAN Manager, LAN Server, NETBIOS, NDIS, ODI, Pathworks, PC LAN Program, PC/TCP, SCO Unix and VINES	DMA	128K bytes	Diagnostic software	TokenView Plus	Bus mastering	$895/lifetime
Racore Computer Products, Inc. **Los Gatos, Calif.** **(408) 374-8290**	M8113	Full	ISA, 16 bit	STP and UTP	NetWare 2.X and 3.X, ODI, Novell's LAN Workplace for DOS, LAN Server, LAN Manager (through an NDIS driver), 3+Open, SCO Unix and VINES	DMA, with burst mode	128K or 512K bytes	Diagnostic software	None	Bus mastering and self-configuring drivers	$845/2 years
	M8114	Full	MCA, 16 bit	STP and UTP	NetWare 2.X and 3.X, ODI, LAN Workplace for DOS, LAN Server, LAN Manager (through an NDIS driver), 3+Open, SCO Unix and VINES	DMA, with burst mode	128K or 512K bytes	Diagnostic software	None	Bus mastering and self-configuring drivers	$845/2 years
	M8115	Half	ISA, 8 bit	STP and UTP	NetWare 2.X and 3.X, ODI, LAN Workplace for DOS, LAN Server, LAN Manager (through an NDIS driver), 3+Open, SCO Unix and VINES	Pseudo DMA	128K bytes	Diagnostic software	None	Bus mastering and self-configuring drivers	$745/2 years
	M8117	Three-fourths	ISA, 16 bit	STP and UTP	NetWare 2.X and 3.X, ODI, LAN Workplace for DOS, LAN Server, LAN Manager (through an NDIS driver), 3+Open, SCO Unix and VINES	DMA, with burst mode	128K or 512K bytes	Diagnostic software	None	Bus mastering and self-configuring drivers	$895/2 years
SBE, Inc. **Concord, Calif.** **(800) 347-2666**	VCOM-33 Token Ring NIC	Full, 6U (160 by 233.35 mm)	VME, 32 bit	STP	NetWare 2.X and 3.X and NETBIOS	Processor-assisted block mode transfer, with burst mode	1M or 4M bytes	8 LEDs, power- up test suite	None	Optional 4-port serial board and optional SRA	$2,615 each when ordered in quantities of 100/1 year
	MLAN-T Token Ring NIC	Full, 6U	Multibus, 16 bit	STP	Sold to OEMs and systems integrators that write software	Processor-assisted block mode transfer, with burst mode	1M or 4M bytes	8 LEDs, power- up test suite	None	Optional SRA	$3,135 each when ordered in quantities of 100/1 year
Thomas-Conrad Corp. **Austin, Texas** **(800) 332-8683**	TC4045 16/4M bit/sec Token Ring Adapter/AT	Full	ISA, 16 bit	STP and UTP	ODI, NDIS, NetWare 2.X and 3.X, LAN Manager, Performance Technology, Inc.'s PowerLAN, 3+Open, PC LAN Program, LAN Server and VINES	DMA, with burst mode	128K, 512K or 2M bytes	LEDs for ring insertion and activity and diagnostic software	Sectra	Bus mastering and pseudo DMA	$849/2 years
	TC4046 16/4M bit/sec Token Ring Adapter/MC	Full	MCA, 16 bit	STP and UTP	ODI, NDIS, NetWare 2.X and 3.X, LAN Manager, PowerLAN, 3+Open, PC LAN Program, LAN Server and VINES	DMA, with burst mode	128K, 512K or 1M bytes	LEDs for ring insertion and activity and diagnostic software (Ring Tools)	Sectra	Bus mastering and pseudo DMA	$750/2 years
Xircom **Calabasas, Calif.** **(800) 874-7875**	16/4 Pocket Token Ring Adapter	External adapter	Parallel port	STP and UTP	3+Open, LANtastic, VINES, DCA's IRMALAN, 10Net, Pathworks, FTP Software, Inc.'s TCP/IP by STP, LAN Server, PC LAN Program, PC Support AS/400, OS/2 Extended Edition, PC 3270, LAN Manager, Microcom, Inc.'s Relay Gold, NETBIOS, NetWare 2.X and 3.X, Persoft, Inc.'s Smart Term, Sun's PC/NFS, Torus Systems Inc.'s Tapestry II LAN Manager, Tandem Computers, Inc.'s Pathway and The Wollongong Group, Inc.'s Access	NA	128K bytes	Diagnostic software	None	None	$895/2 years

DMA = Direct memory addressing
EISA = Extended Industry Standard Architecture
ISA = Industry Standard Architecture
MAU = Multistation access unit
MCA = Micro Channel Architecture
NA = Not applicable

NDIS = Network Device Interface Specification
ODI = Open Datalink Interface
SCO = The Santa Cruz Operation, Inc.
SRA = Source Routing Accelerator
STP = Shielded twisted pair
UTP = Unshielded twisted pair

This chart includes a representative selection of token-ring adapters. These vendors may offer other adapters, and other vendors not included may offer a full range of products.

SOURCE: MICHAEL HURWICZ, EASTSOUND, WASH.

16M bit/sec token-ring MAUs

Company	Product	Number of ports and cable type	Diagnostics	Management from same vendor	Other features	Price/warranty
Accton Technology Corp. Fremont, Calif. (510) 226-9800, (800) 926-9288	RingHub-300	8 UTP (ring in and ring out are STP)	LEDs for port status	None	None	$459/2 years
	RingHub-100	8 STP	LEDs for port status	None	None	$529/2 years
AMP, Inc. Harrisburg, Pa. (717) 564-0100, (800) 522-6752	AMPTRAC 8 Token Ring Concentrator	8 STP or UTP	LEDs for port status	None	Reset button	$495/1 year
BICC Communications Westborough, Mass. (508) 832-8650, (800) 447-6526	InfraLAN 16/4	6 STP (or 4 if 2 are used for ring in and ring out)	LEDs on optical tranceiver for power and signal strength, LEDs on optical MAU for power, upstream wrap, downstream, primary ring, backup ring, 4M or 16M bit/sec speed and ring in/ring out in use	None	Uses infrared light to connect MAUs	Not set, approximately $3,500 to $3,900/1 year (available this month)
CNET Technology, Inc. San Jose, Calif. (800) 486-2638	CN1000TC1	8 STP	LEDs for port status	None	None	$549/1 year
	CN1000TC3	8 UTP	LEDs for port status	None	None	$549/1 year
Digital Communications Associates, Inc. Alpharetta, Ga. (800) 348-3221	IRMAtrac Fiber Optic Token-Ring MAU	16 fiber optic	LEDs for ring insertion, speed, link status, ring-in activity	None	Fiber optic and STP ring in and ring out	$4,995/1 year
IBM Armonk, N.Y. (914) 765-1900, (800) 426-3333	8228 Multistation Access Unit	8 STP	None	IBM's NetView	None	$630/1 year
Madge Networks, Inc. San Jose, Calif. (408) 441-1300, (800) 876-2343	8 Station Ringhub	8 STP	None	None	Reset button	$715/1 year
	Local Ringhub	4 STP, only ring in (no ring out)	None	None	None	$450/1 year
Olicom USA, Inc. Richardson, Texas (214) 680-8131	Multistation Access Unit	8 STP	8 LEDs for network activity, LED for battery status	None	Reset button	$650/1 year
Optical Data Systems, Inc. (ODS) Richardson, Texas (714) 234-6400	ODS 841 Token Ring MAU	16 fiber optic	Tri-color LEDs for port activity, status and faults	None	Optional out-of-band network management ($1,140), optional in-band reporting to IBM LAN Network Manager, NetView PC and NetView ($3,730), optional local bridging ($6,615), optional remote bridging ($7,815)	$7,630/1 year
	ODS 861 Token-Ring MAU	16 UTP or STP	Tri-color LEDs for port activity, status and faults	None	Optional out-of-band network management ($1,140), optional in-band reporting to IBM LAN Network Manager, NetView PC and NetView ($3,730), optional local bridging ($6,615), optional remote bridging ($7,815)	$5,550/1 year
Proteon, Inc. Westborough, Mass. (508) 898-2800, (800) 545-7464	ProNET Series 70 Intelligent Wire Center	8 STP or UTP, and ring in and ring out both STP and UTP	1 LED per port for ring insertion, 1 LED per ring-in, ring-out port for network fault	Company's TokenVIEW Plus, OVERVIEW	Out-of-band management	$1,295/1 year
	ProNET Series 70 Workgroup Wire Center	4 UTP	1 LED per port for ring insertion, 1 LED per ring-in, ring-out port for network fault	Company's TokenVIEW Plus, OVERVIEW	Out-of-band management	$495/1 year
Thomas-Conrad Corp. Austin, Texas (800) 332-8683	TC4050-16 16-port Token Ring MAU	16 UTP, ring in and ring out both STP and UTP	LEDs for network activity	Sectra	Self-powered, autoaligned relays	$985/2 years

MAU = Multistation access unit
STP = Shielded twisted pair
UTP = Unshielded twisted pair

This chart includes a representative selection of 16M bit/sec token-ring multistation access units. These vendors may offer other such products, and other vendors not included may offer a full range of comparable products.

SOURCE: MICHAEL HURWICZ, EASTSOUND, WASH.

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Hubs and MAUs serve as concentration or connection points for token-ring devices. MAUs, which provide a fixed number of ports and support only token-ring devices, are usually non-modular and passive. Hubs, on the other hand, provide a variable number of ports. They are active, modular devices, often with significant processing power, and mostly support more than one type of LAN, such as Ethernet and token ring.

Although most MAUs have little or no processing power, there are some exceptions. For instance, the Optical Data Systems, Inc. (ODS) 841 and 861 are examples of active MAUs with optional intelligent management modules. Proteon, Inc.'s Intelligent Wire Center and Workgroup Wire Center are active MAUs with processors to run network management software.

But the basic building block for a token-ring network is the adapter card that resides in desktop devices such as a microcomputer. Most token-ring cards operate at 4M or 16M bit/sec. When selecting token-ring cards, users should consider several obvious factors, such as matching the card to their computer's bus and the building's cabling system. Less obvious factors that may have a dramatic effect on performance include driver software, I/O architecture and bus width.

Most vendors of personal computer-architecture cards make both Micro Channel Architecture (MCA) and Industry Standard Architecture (ISA) models. At least one vendor, National Data Communications, Inc. (NDC) currently limits its offerings to the ISA bus. Avatar Corp., Madge Networks, Inc., Olicom USA, Inc. and Proteon also make cards for the Extended ISA (EISA) bus.

Non-PC-architecture cards include Macintosh cards from Asante h-three Systems, Avatar and Digital Communications Associates, Inc.; VME and multibus cards from SBE, Inc.; and external adapters from Accton Technology Corp., CNet Technology, Inc., IQ Technologies, Inc. and Megahertz Corp.

Network World tests of MCA and ISA 16M bit/sec token-ring cards indicate bus type plays a minor role in determining performance ("16M bit/sec token-ring adapters outpace Ethernet," *NW*, Jan. 14, 1991). For instance, the fastest card in *Network World's* tests was Madge Networks' Smart 16/4 AT Ringnode, an ISA card. Racore Computer Products, Inc.'s M8114 (an MCA card) and M8113 16/4 Token-Ring Adapter (an ISA card) performed similarly in terms of speed.

Independent benchmarks for 16M bit/sec token-ring EISA cards are not yet available.

Similar performance is reflected in similar pricing. Accton, Andrew Corp., DCA, IBM, Lantana Technology, Inc., NCR Corp., Olicom and Racore have identically priced MCA and ISA cards. Proteon and Thomas-Conrad Corp. charge more for their ISA cards than they do for their MCA cards. CNet charges more for its MCA cards.

Some current prices reflect vendors' beliefs that EISA can be substantially faster than ISA or MCA, especially on heavily loaded computers. For instance, Madge Networks charges substantially more for its 32-bit EISA card than for its 32-bit MCA card. But other vendors, such as Avatar and DCA, charge the same for EISA as they do for ISA and MCA cards.

Another factor in choosing an adapter card is the need to match your cabling system. Most of the cards listed in the charts support either shielded twisted pair or both shielded and unshielded twisted pair.

CNet's 50TR3 external adapter is the lone product listed that supports 16M bit/sec token ring on unshielded twisted pair only. Other cards, such as DCA's IRMAtrac and MacIRMAtrac support unshielded or shielded twisted pair at 4M bit/sec, but only shielded twisted pair at 16M bit/sec.

A few vendors, such as DCA and ODS, make 16M bit/sec token-ring boards for fiber-optic cable. ODS modifies boards made by Olicom to produce its line of fiber-optic, 16M bit/sec token-

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Hubs supporting 16M bit/sec token ring

Company	Product	Maximum number of ports	Diagnostics	Management	Other LAN types on same hub	Other types of modules for hub	WAN interfaces and links	Reliability features	Other features	Price/warranty
AMP, Inc. Harrisburg, Pa. (800) 522-6752, (717) 564-0100	AMPTRAC 16	260 STP or UTP (13 LEMs with 20 ports each)	None on chassis	SNMP agent included free, physical layer management and MAC layer management software are $2,000 each up to 10 LEMs, $3,000 each over 10 LEMs, IBM NetView agent $1,000 up to 10 LEMs, $2,000 over 10 LEMs	None	None	None	Hot-swapping, out-of-band management, power supplies in chassis and each LEM	LEMs can be 100 meters from base chassis, each port handles 1 PC, MAU or LEM	Base chassis, $1,500; 8-port ring access control modules, $675 (1 PC, MAU or LEM per port); physical layer management module, $500; MAC layer management module, $1,000 /1 year
	Lobe Expansion Modules	20 STP or UTP	LEDs for ring insertion, port isolated by network management system and presence of 5-volt current for token-ring relays	Physical layer management in each LEM, SNMP agent	NA	NA	NA	LEMs can operate independently of base chassis	Local memory for storing management information	$1,895/1 year
Bytex Corp. Southborough, Mass. (508) 480-0840	Maestro Intelligent Switching Hub	144, plus 5 option slots for bridging or routing	Inventory scanner	Maestro Network Management System	Ethernet (available the middle of this year)	Bridge (available second half of this year)	None	Hot-swapping, out-of-band management, redundant load-sharing power supplies	Per-port switching	$8,655 for hub alone; $22,495 for hub, Maestro Network Management Software on a Sun Microsystems, Inc. SPARCstation2 /1 year
	Token Ring Station Port Module	12 UTP or STP ports	LEDs for port status	NA	NA	NA	NA	NA	Mix 4M and 16M bit/sec on same port module	$1,795 (STP), $2,200 (UTP)/1 year
Cabletron Systems, Inc. Rochester, N.H. (603) 332-9400	MMAC-3, MMAC-5, MMAC-8	48, 96, 168, STP, UTP or fiber (depends on module)	Diagnostics on modules	Remote LANView/ Windows ($4,995)	FDDI, Ethernet, Apple Computer, Inc.'s LocalTalk (module from Cayman Systems, Inc.)	Bridge	None	Hot-swapping, out-of-band management, redundant power supplies	SNMP manageable	$1,250, $1,550, $1,850/90 days
	Token Ring Management Module	2 RS-232 for out-of-band management and modem	5 LEDs	Works with company's Remote LANView/ Windows	NA	NA	NA	None	RISC processor	$4,995/90 days
	Token Ring Repeater Media Interface Module	12 active, UTP or STP	LEDs for port activity	NA	NA	NA	NA	NA	Fiber optic	$4,795/90 days
	Token Ring Media Interface Module-12	12 passive, STP	LEDs for port activity	NA	NA	NA	NA	NA	None	$1,295/90 days
	Token Ring Media Interface Module-22	12 active or 12 passive, UTP	LEDs for port activity	NA	NA	NA	NA	NA	Fiber optic	$2,095 active, $1,295 passive/90 days
	Token Ring Media Interface Module-24	24 active, UTP	LEDs for port activity	NA	NA	NA	NA	NA	None	$3,795/90 days
Chipcom Corp. Southborough, Mass. (508) 460-8900	ONline System Concentrator (6-slot model)	40 (5 ONline Token Ring MAU modules)	LEDs for port status, management module	ONline Network Control System	Ethernet, FDDI (to be announced in 1992)	Bridge, router	X.25 and frame relay on router module	Hot-swapping, out-of-band management, redundant power supplies	SNMP manageable	$2,295/1 year
	ONline System Concentrator (17-slot model)	128 (16 ONline Token Ring MAU modules) STP or UTP	LEDs for port status, management module	ONline Network Control System	Ethernet, FDDI (to be announced in 1992)	Bridge, router	X.25 and frame relay on router module	Hot-swapping, out-of-band management, redundant power supplies	SNMP manageable	$4,950/1 year
	ONine Token Ring MAU Module	8 STP or UTP (both through RJ-45)	LEDs for port status, management module	ONline Network Control System	NA	NA	NA	NA	SNMP manageable	$1,195/1 year
IBM Corp. Armonk, N.Y. (914) 765-1900, (800) 426-3333	8230 Controlled Access Unit	80 (up to 4 Lobe Access Modules)	8230 maintenance utility	LAN Network Manager	None	None	None	Automatic ring recovery, isolates failing ports	Access control	$3,150/1 year
	Lobe Access Module	20 STP	LEDs for port activity	LAN Network Manager	NA	NA	NA	Hot-swappable lobe attachments	None	$2,150/1 year
Luxcom, Inc. Fremont, Calif. (800) 322-5000	2091A Base Module and 2020A Control Module	128	LEDs for faults, configuration errors, mode, network management station activity, hub activity, 2 for receive signal strength	Network Management Station software	10Base5, 10Base2, 10Base-T	2170A 4M/16M bit/sec Token Ring Repeater, 3270 Terminal Access Module, IBM 5250 Terminal Access Module, IBM 5080 Terminal Access Module, RS-232, V.35	None	Rugged packaging, hot-swapping, redundant power supplies, out-of-band management, redundant control module (to be available in the second quarter of this year)	None	$4,990/1 year
	2171A 4M/16M bit/sec Token Ring MAU	16 UTP (adapter for STP, $30 each)	Status LED for each port, 1 fault indicator LED per module	Network Management Station software	NA	NA	NA	Rugged packaging	Jitter elimination	$1,995/1 year

LEM: Lobe Expansion Module
MAC: Media Access Center
MAU: Multistation access unit
MMAC: Multi Media Access Center

NA: Not applicable
SNMP: Simple Network Management Protocol
STP: Shielded twisted pair
UTP: Unshielded twisted pair

This chart includes a representative selection of hubs supporting 16M bit/sec token ring. These vendors may offer other such products, and other vendors not included may offer a full range of comparable products.

SOURCE: MICHAEL HURWICZ, EASTSOUND, WASH.

Hubs supporting 16M bit/sec token ring

Company	Product	Maximum number of ports	Diagnostics	Management	Other LAN types on same hub	Other types of modules for hub	WAN interfaces and links	Reliability features	Other features	Price and warranty
Optical Data Systems, Inc. (ODS) Richardson, Texas (714) 234-6400	ODS 289	16 (1 slot, 16 ports) UTP, STP or fiber (depends on module)	Tricolor LEDs for port activity, status and faults	Optionally, box can be used for reporting to SNMP, IBM's LAN Network Manager, NetView ($3,730)	Ethernet	None	None	Hot-swapping	None	$750/1 year
	ODS 292	64 (4 slots, 16 ports per slot) UTP, STP or fiber (depends on module)	Tricolor LEDs for port activity, status and faults	Optional reporting to SNMP, IBM's LAN Network Manager, NetView ($3,730)	Ethernet	Local bridge ($6,615)	Remote bridge ($7,815)	Hot-swapping, optional out-of-band management ($1,140)	1 Ethernet or token-ring bus supports up to 4 separate networks	$850 (chassis), $1,045 (power supply)/1 year
	ODS 295 or 296	192 (12 slots, 16 ports per slot) UTP, STP or fiber (depends on module)	Tricolor LEDs for port activity, status and faults	Optional reporting to SNMP, IBM's LAN Network Manager, NetView ($3,730)	Ethernet	Local bridge ($6,615)	Remote bridge ($7,815)	Hot-swapping, optional out-of-band management ($1,140), optional redundant power supply	Token-ring bus can be configured as 1, 2 or 3 separate buses for the 295 and 296; 296 has 3 separate Ethernet buses	$2,085 (chassis supports 1 power supply), $1,210 (nonredundant power supply), $2,230 (chassis supports 2 power supplies), $1,590 each (redundant power supplies)/1 year
SynOptics Communications, Inc. Santa Clara, Calif. (800) 776-6895, (408) 988-2400	LattisNet System 3000 Intelligent Hub	132 (11 UTP token-ring host modules)	LED for power	LattisNet Network Management System modules for token ring ($4,995), Ethernet ($3,995) and FDDI ($14,995)	Ethernet, FDDI	Ethernet local bridge, Ethernet local router	Ethernet remote bridge and Ethernet remote router	Hot-swapping, out-of-band management, redundant management modules, redundant power supplies	Jitter elimination, SNMP manageable	$3,495/1 year; $3,995 with support for redundant power supply, $1,650 for second power supply
	3502-A Token Ring Host Module	12 UTP or STP	Status LEDs for port activity	LattisNet Network Management system	NA	NA	NA	NA	None	$1,295/1 year
	3505-A UTP Token Ring Host Module	12 UTP	Status LEDs for port activity	LattisNet Network Management System	NA	NA	NA	NA	Jitter elimination	$2,095/1 year (available January 1992)
Ungermann-Bass, Inc. Santa Clara, Calif. (800) 873-6381	Access/One Smart Hub	12 to 120 STP or UTP	LED on module	NetDirector, SNMP agent	Ethernet, FDDI, Apple's LocalTalk	T-1/E-1, V.35	Bridge, router, asynchronous, 3270 terminal server	Auto fault isolation and recovery	Jitter elimination, topological support map, SNMP manageable	$995/1 year
	16/4 Token Ring Concentrator ASM410T	20 (50 pin, generally to punchdown block) UTP or STP	Status LED for module	NetDirector, SNMP agent	NA	NA	NA	NA	Optional daughterboard for jitter elimination, automatic fault recovery, ring monitoring and port-level statistics	$1,150 or $1,900 with daughterboard/1 year

LEM = Lobe Expansion Module
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This chart includes a representative selection of hubs supporting 16M bit/sec token ring. These vendors may offer other such products, and other vendors not included may offer a full range of comparable products.

SOURCE: MICHAEL HURWICZ, EASTSOUND, WASH.

(continued from page 29)

ring adapters.

Cards designed for shielded twisted pair have a nine-pin DB9 port. Those designed for unshielded twisted pair have an RJ45 modular telephone-type connector and an on-board media filter to meet the Federal Communications Commission's radiated emissions standards.

Shielded twisted pair-only cards can be adapted to unshielded twisted-pair cabling systems through add-on media filters costing less than $100 each. One filter is required for each network interface card. Chipcom Corp. makes such a media filter that will work with any vendor's card.

Users should also confirm that the card is designed for the computer bus speed. Most computer buses run at 8 MHz, so most cards were primarily designed with that speed in mind. However, some computer manufacturers have boosted performance by raising bus speeds to 10 MHz, 12 MHz or other speeds.

However, some vendors' cards designed to run only at 8 MHz may not function reliably in machines with higher bus speeds. Examples of potential problems include: the computer may report a parity error, indicating a memory error; the monitor may go black; the system may hang; or the keyboard may be locked out, according to Don Rooney, Accton's manager of technical support. The problem, he says, stems from the fact that the chips on the card cannot keep up with the speed of the bus.

Many vendors, including DCA and Proteon, say they have dealt with this problem and their boards now work fine with various bus speeds. However, users should question vendors about compatibility and test cards from vendors who cannot provide firm assurances.

Four PC transfers

Another significant factor in performance is the method used to transfer information between the PC and the card. There are four methods in common use. From slowest to fastest, they are mapped or programmed I/O, shared memory, direct memory access (DMA) and bus master DMA. Burst mode is a further refinement of bus master DMA.

Shared memory uses the PC's memory bus to move information, while programmed I/O uses the PC's I/O registers. Because I/O registers take more clock cycles than the memory bus to move the same amount of information, shared memory is faster, says Carl Blume, Proteon's senior product manager for token-ring network interface cards.

DMA, typically used in conjunction with shared memory, can speed the process even further by using the PC's specialized DMA circuitry instead of the PC's CPU to supervise the transfer, he adds.

Even shared-memory DMA requires a two-step process, Blume says. One step moves data between the system memory and the PC's DMA controller. Another step transfers it between the DMA controller and the network interface card.

Bus master cards transfer data in a single step, directly from system memory to the card, without using the PC's CPU or DMA controller. Thus, a bus master card takes half the clock cycles and is often twice as fast as shared-memory DMA, Blume says. The burst mode class of bus master transfers work more efficiently by holding the bus for a longer period of time and transferring more data within that period of time.

Cards built using Texas Instruments, Inc.'s token-ring chipset support a mode called pseudo DMA, in which programmed I/O is used to emulate shared memory. This provides faster speed than ordinary programmed I/O. TI's 16M bit/sec chipset is used by most vendors except for IBM, which uses its own chipset.

Experts agree that users looking for high performance should buy only DMA or bus master cards. In contrast, programmed I/O and shared memory are used primarily by low-end cards, such as 8-bit cards, or by external adapters communicating through an inherently slow parallel port. Users looking for maximum performance should consider cards that support burst mode.

A number of vendors, including DCA, NCR, Olicom and Thomas-Conrad, sell only DMA bus master cards with burst mode. Others, such as Proteon, sell only bus master cards, both with and without burst mode. But there's often a higher cost that goes with bus master and burst mode cards. For example, IBM's bus master MCA card costs $1,030, while its non-bus master MCA card costs $895. Proteon's burst mode 32-bit EISA card costs $1,195. Compare this to other Proteon cards priced at $750 and $895.

Random-access memory on the adapter card may be important to increase communications speed on heavily loaded computers, such as servers. The TI chipset will support as many as 2M bytes of RAM. However, most cards have 128K bytes of RAM and cannot be upgraded. Some, such as Andrew Corp.'s Token Ring Adapter Card 4/16 AT and Racore's M8113, M8114 and M8117 come standard with 128K bytes of RAM but can be upgraded to 512K bytes. Thomas-Conrad and DCA make cards that are upgradable to 1M or even 2M bytes of RAM. In most cases, however, 128K bytes is sufficient RAM for a 16M bit/sec token-ring card.

Hubs and MAUs

Once cards have been selected, users can concentrate on choosing the correct hub or MAU. In selecting a hub, they should consider whether it offers out-of-band management, which will provide fault information from the hub, even when the network is down. Hubs supporting out-of-band management include the Maestro Intelligent Switching

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Hub from Bytex Corp., the Multi Media Access Center from Cabletron Systems, Inc., the ONline System Concentrator from Chipcom, and all ODS hubs except the single-slot 289.

Another useful feature is the ability to divide the hub into multiple token rings for performance tuning and troubleshooting. The Maestro Intelligent Switching Hub, for instance, allows the user to create 32 separate token-ring networks within a single hub.

In contrast to hubs, MAUs are often valued primarily for their simplicity and low cost. Thus, they offer few special features.

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Hot swapping, the ability to remove a module and insert a new one without powering down the hub, enables the user to keep the network up during problem resolution. This is particularly important in hubs that support large numbers of users. All the hubs in the chart support hot swapping.

In contrast to hubs, MAUs are often valued primarily for their simplicity and low cost. Thus, they offer few special features. Some MAUs have reset buttons that make it possible to initialize ports without an insertion tool such as that required by the IBM 8228 MAU.

Madge Networks and Olicom make MAUs with reset buttons, while Thomas-Conrad's MAU has autoaligned relays that automatically initialize when a connector is inserted in the port.

Like the adapter card vendors, most hub and MAU vendors listed in the charts support 16M bit/sec token ring over unshielded twisted pair. The vendors contend that early jitter problems associated with the TI chipset have been overcome through better adapter board and hub design. Users and analysts agree that 16M bit/sec token rings are now extremely reliable.

"The jitter problem has been corrected," says Bill Redman, a vice-president in the network services group of Gartner Group, Inc., a Stamford, Conn.-based market research and consulting firm. He says early problems were largely due to poor vendor implementations, rather than the TI chipset. Vendors have also universally improved their designs so that jitter problems have been eliminated as long as the network is implemented within design specifications.

Throttled by the media

The grade of unshielded twisted-pair cable being used is also a critical consideration in ensuring that a 16M bit/sec token-ring network works well. For instance, a 16M bit/sec token ring running on data-grade unshielded twisted pair may not work on older voice-grade unshielded twisted pair. California Polytechnic State University in San Luis Obispo found that out the hard way.

The school had to throttle back a 16M bit/sec token ring because of severe slowdowns in the ring's throughput that were apparently caused by use of installed voice-grade twisted pair cabling. The ring is now running at 4M bit/sec.

David Mason, assistant systems analyst in the information systems department at the university, says he's not sure whether the slowdowns on the 32-node 16M bit/sec token ring installed in late 1990 were attributable to jitter, but tests indicate that reducing the data rate to 4M bit/sec will eliminate the problem.

"I'm sure it would work fine on data-grade unshielded twisted pair as opposed to the older voice-grade [unshielded twisted pair]," he says.

IBM's blessing

Early vendors of 16M bit/sec token-ring equipment, such as Proteon, used filtering techniques that supported 100-meter runs over data-grade and high-quality voice-grade unshielded twisted pair, but not over low-quality unshielded twisted pair.

Vendors have universally improved their designs so that jitter problems have been eliminated.

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During 1990, phase locked loop (PLL) technology was released to decrease jitter, thereby increasing the number of workstations and the length of runs permitted in a token-ring network. PLL technology was incorporated in all 16M bit/sec adapter cards, making it possible for shielded twisted-pair networks to support as many as 250 nodes and 100-meter lobe lengths. (A lobe is the cable that connects a node to a MAU or hub.) Use of PLL technology on adapter cards now allows 16M bit/sec token-ring networks to support 132 nodes and 100-meter lobe lengths over high-quality unshielded twisted pair.

Recently, an even newer approach was unveiled. In November, IBM and SynOptics Communications, Inc. announced jointly developed "ringing tank" circuits, which allow even low-grade unshielded twisted pair to support 100-meter runs at 16M bit/sec. The circuits are designed to be used on each port of a hub and consist of resistive, capacitive and inductive components that tend to ring or oscillate at a particular frequency, while damping out all other frequencies. This helps keep the raw transmission speed of the ring at exactly 16M bit/sec.

The IBM-SynOptics technology will accomplish its job at about one-fifth the cost of PLL technology, which in theory could be employed in hubs to lengthen runs, says Bob Smith, SynOptics' senior principal engineer. The cost-effectiveness of the ringing tank technology makes it more feasible for low-cost hubs. Ringing tank technology is straightforward and well-understood. It could be easily implemented by other vendors.

SynOptics' 12-port 3505-A Token Ring Host Module, which incorporates the newly announced technology, is inserted into SynOptics' LattisNet System 3000 Intelligent Hub. It will be available in January 1992 and cost $2,095, the same as the current 12-port 3505 Token Ring Host Module.

The current module can support 100-meter lobes on low-grade unshielded twisted pair. However, it requires cable qualification, choosing the best available pairs in a bundle of twisted-pair wire, says John Armstrong, SynOptics' senior product marketing manager for token-ring systems. The 3505-A will support the same length lobes without selecting the best pairs.

IBM will later this year incorporate the same technology in an unshielded twisted-pair Lobe Access Module (LAM) for its 8230 Controlled Access Unit, a $3,150 hub, says Roger Ehrig, an IBM consulting product administrator. Current LAMs, which support only shielded twisted pair and do not use the new technology, cost $2,150.

IBM and SynOptics have submitted their technology to the IEEE 802.5 committee for consideration as a standard, but the technology will likely be tweaked before it is accepted, says Gartner Group's Redman. The inclusion of the IBM-SynOptics technology, along with existing PLL and passive filtering technology, in 16M bit/sec token-ring standards will help ensure interoperability between equipment from different vendors and, thus, protect users' investments.

Users with runs of older voice-grade unshielded twisted-pair wiring approaching 100 meters may want to look into hubs that incorporate the IBM-SynOptics ringing tank technology. So far, only SynOptics has announced such hubs. Users with relatively short cable runs, or with shielded twisted pair, data-grade unshielded twisted pair or newer voice-grade unshielded twisted pair, should be able to run 16M bit/sec token ring using hubs and MAUs from any of the listed vendors.

More good news

Adding to the good news of the IBM-SynOptics announcement are other recent advances in 16M bit/sec equipment. Take performance, for example: While early rings provided a 16M bit/sec raw transmission speed, actual data throughput was scarcely better than that of 4M bit/sec rings and arguably worse than that of 10M bit/sec Ethernets, based on tests reported previously in *Network World* ("16M vs. 4M token ring: Fourfold improvement?" *NW,* Feb. 12, 1990).

However, vendors soon realized performance limitations at 16M bit/sec were largely due to adapter board driver software that was not optimized for the higher speed. New drivers brought dramatic results. A year ago, tests showed the Madge Networks Smart 16/4 AT Ringnode adapter could transfer data at an impressive 14.9M bit/sec, outdistancing 4M bit/sec token ring and even 10M bit/sec Ethernet by a substantial margin.

In April 1991, TI introduced upgraded Turbomac media access control software that can improve performance even further. For instance, since September of 1991, Racore has been shipping software that incorporates Turbomac. The new software has increased performance almost 50% in some cases, according to John LaPorta, Racore's president.

Despite technical advances, the 16M bit/sec token ring still faces problems, the biggest of which is its relatively high price.

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Despite these technical advances, the 16M bit/sec token ring still faces several problems, the biggest of which is its relatively high price. The typical 16M bit/sec adapter card for the ISA or MCA bus costs $700 to $900. By contrast, comparable Ethernet cards range from $175 to $700, with many falling in at the lower end of that range.

For both Ethernet and token ring, quantity discounts may be available. Madge Networks, for instance, gives discounts of $100 per card for its token-ring MCA and ISA cards when bought in packages of 10 and for its EISA cards in five-packs. NDC gives discounts of about 10% in quantities of 10. Many vendors will negotiate quantity discounts on an individual basis.

Even considering the relatively high prices of 16M bit/sec token ring, existing 4M bit/sec token-ring users rarely desert to Ethernet. Most are upgrading to 16M bit/sec, says IDC's Doyle. According to an IDC report issued last May, of the 2.7 million token-ring adapter cards that were expected to be shipped during 1991, two-thirds would be 4M/16M bit/sec cards. However, the firm estimated that of the 8.5 million adapter cards expected to ship in 1991, 3.9 million would be Ethernet cards.

Final advice

While its users remain loyal to token ring, chosing the fastest token-ring equipment is not easy. Cards from different vendors may provide widely varying levels of performance, based partly on physical characteristics and partly on the software drivers. Since vendors are able to revise their software drivers frequently, it is difficult to determine which card and driver combination is best.

Therefore, users have to find recent benchmarks or conduct their own tests to know how a particular card and driver combination will perform. However, cards are never going to go much faster than 14.9M bit/sec on a 16M bit/sec token ring.

While it faces competition from Ethernet and FDDI, 16M bit/sec token ring is rapidly becoming the technology of choice for token-ring users. Now that its technical hurdles have been overcome, it is beginning to fulfill the promises made at its introduction three years ago.

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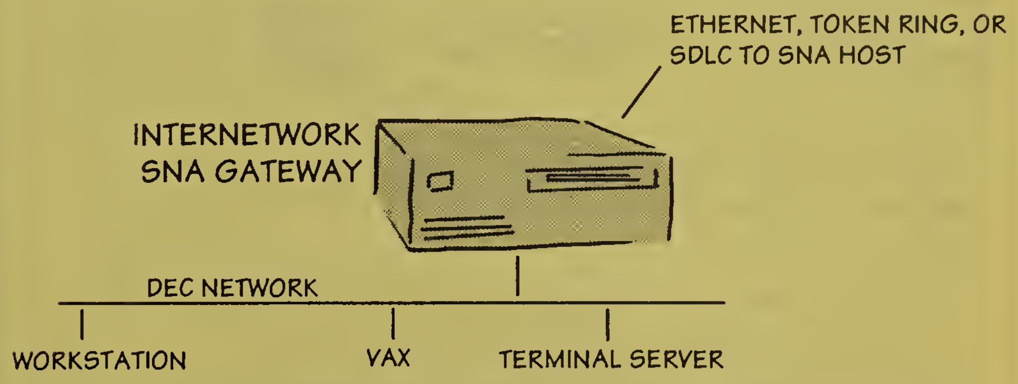

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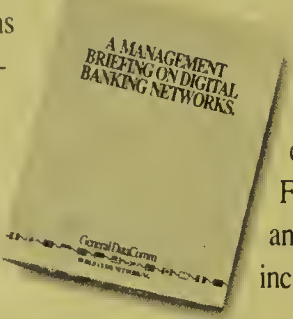

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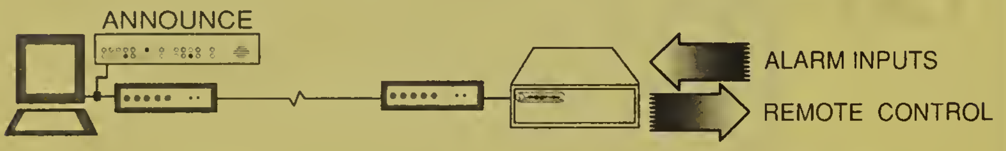

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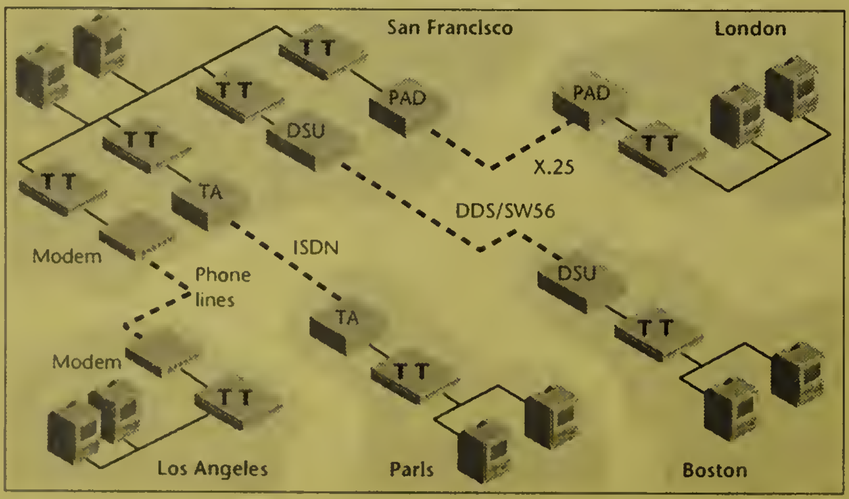

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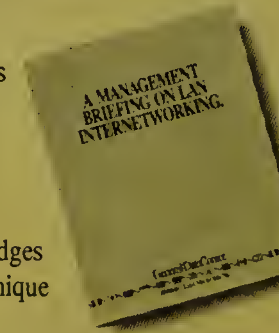

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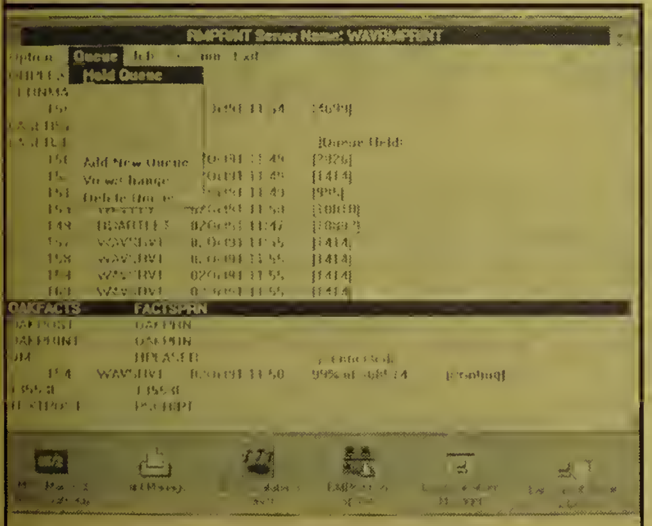

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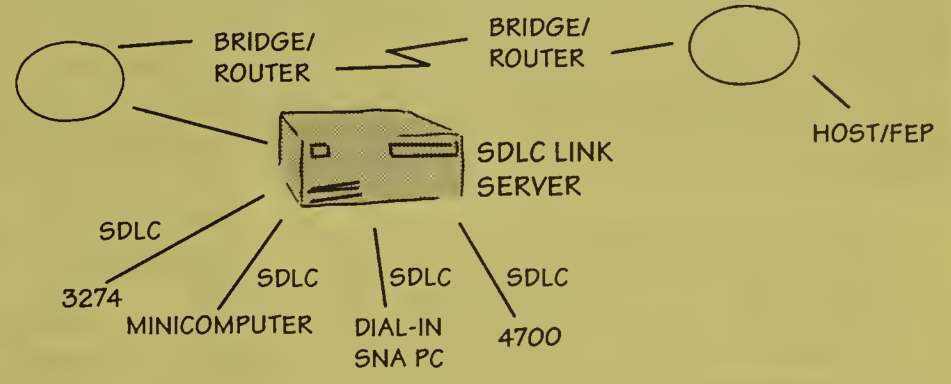

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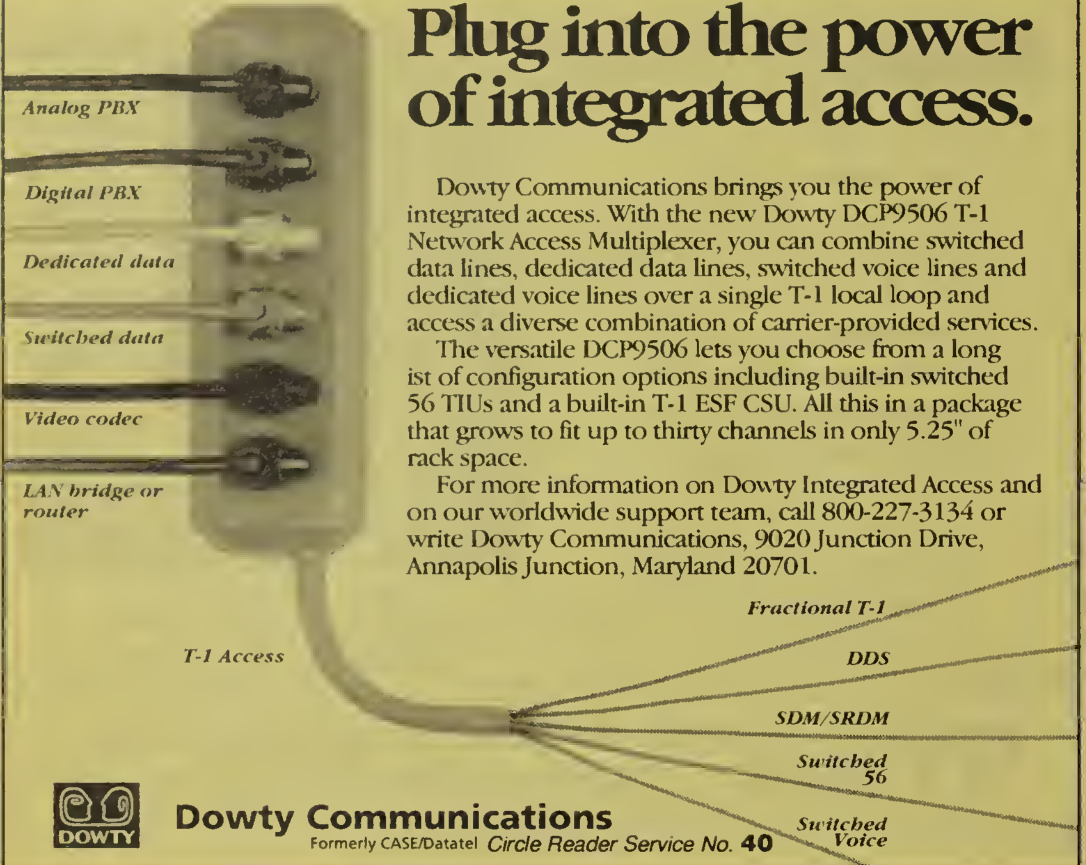

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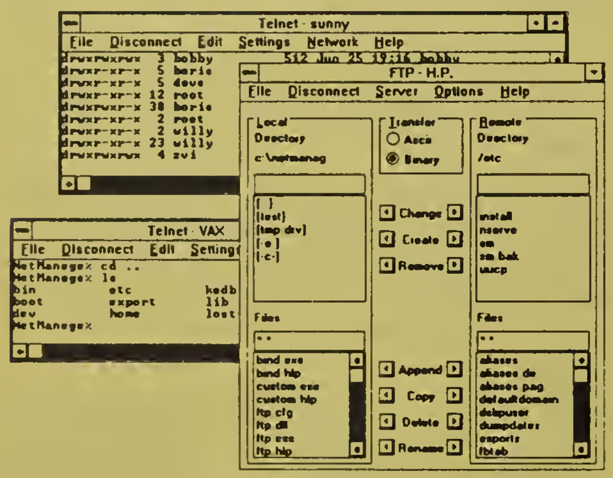

```
drwxrwxrwx  3 bobby          512 Jun 25 19:16 bobby
drwxr-xr-x  5 boris
drwxr-xr-x  5 dave
drwxr-xr-x 12 root
drwxrwxr-x 38 boris
drwxr-xr-x  2 root
drwxr-xr-x  2 willy
drwxr-xr-x 23 willy
drwxrwxrwx  4 zvi
```

```
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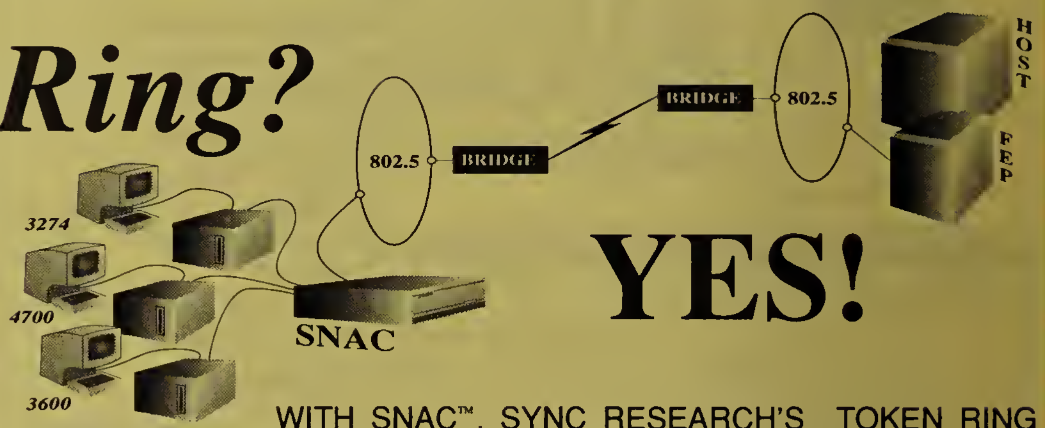

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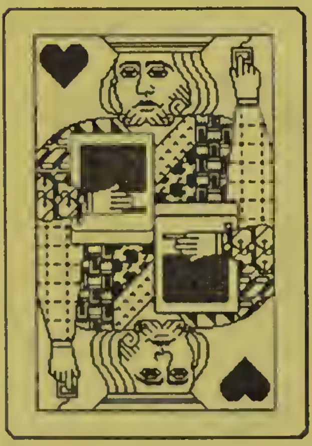

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Jan 27 (Jan 15 Close); Topic: Special/Supplement, Applications; 1. Annual Salary Survey, 2. LAN management supplement, Buyer's Guide: Videoconference equipment; Show Distribution: ComNet East; Lead Service

Feb 3 (Jan 22 Close); Topic: Internetworking; Buyer's Guide: Frame relay

Feb 10 (Jan 29 Close); Topic: LAN; 1. Networking Windows 2. LAN management; Show Distribution: NetWorld Boston; Lead Service

Feb 17 (Feb 5 Close); Topic: Internetworking; Guide To Strategic Purchase Decisions: Outsourcing

Feb 24 (Feb 12 Close); Topic: WAN; ACD options; Lead Service

Mar 2 (Feb 19 Close); Topic: LAN; Buyer's Guide: LAN E-mail (X.400 and otherwise)

Mar 9 (Feb 26 Close); Topic: Global Networks; Selecting an international hub; Show Distribution: DCI Downsizing/Cebit; Lead Service

Mar 16 (Mar 4 Close); Topic: Internetworking; Computer Integrated Manufacturing (CIM) strategies; Show Distribution: ENE '92

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Mac demo to headline expo

continued from page 2

In addition to featuring available products and services, several Proto/CALL Group vendors will unveil new offerings or detail undertakings designed to enhance Macintosh's networking capabilities, Weigand said.

International Transware is expected to announce that it has teamed with Golden Gate University here to begin construction of a statewide AppleTalk backbone net in California that schools and companies can use to connect geographically dispersed Macintoshes. The network will initially use Pacific Bell-provided leased lines to link the university's School of Telecommunications Management with its southern campus in Irvine, Calif.

Customers will be able to use either switched or dedicated links in order to access the network, which will support file transfer, screen sharing, electronic mail and facsimile applications.

Weigand hopes the backbone will attract other universities and commercial users. "We want this project to serve as a catalyst and help promote the use of Macintoshes in wide-area networks," he said.

In the conference demonstration, a single Macintosh on an Appletalk local-area network will be equipped with Northern Telecom software that lets it establish video calls over Centrex lines.

A video camera on the Macintosh will then be able to transmit the user's image over a single twisted-pair wire to a video switch. That switch will pass the image to a PictureTel coder/decoder, which encodes the signal and directs it to an Ascend Multiband inverse multiplexer.

The Ascend box will dial up a Pacific Bell Integrated Services Digital Network Centrex line and split the signal among the line channels for transmission. Although the Ascend unit can establish six dial-up 64K bit/sec channels, only 112K bit/sec of bandwidth will be used.

Pacific Bell will pass the video signal to AT&T for cross-country transmission using two Accunet Switched 56 dial-up links to New Jersey Bell Telephone Co. That company will complete the link by delivering the signal over two switched 56K bit/sec circuits to Jersey City State College in N.J.

At the show, the Macintoshes will be linked to a Tribe Computer Works, Inc. wiring hub supporting an AppleTalk LAN and providing connections to other Macintoshes, V.42 modems and two Acropolis World Access data service units.

Users said the demo is a milestone in the Macintosh evolution. "The inclusion of voice and video capabilities in the Macintosh is a big plus and will increase its functionality," said Harvey Shrednick, vice-president of information services for Corning Glass Works in Corning, N.Y.

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Proteon airs net mgmt. products

continued from page 8

Both AT&T and DEC are using Proteon's SNMP/TR software to develop modules for their respective integrated management systems, Shah said.

DEC will support management of Proteon's hubs within six months, while AT&T's schedule has not been set, he said. Other third-party vendors are also expected to support the SNMP/TR software.

Proteon itself has developed an SNMP link to IBM's NetView and Systems Center's Net/Master management systems, the two leading IBM Systems Network Architecture management systems.

Proteon's SNMP to NetView Gateway is a bidirectional gateway designed to run on a PC under OS/2 Extended Edition. It translates SNMP alerts into native NetView language and NetView commands, and then queries back into SNMP.

The SNMP to NetView Gateway, which also supports Net/Master, will be available in February for $4,995.

Paperfree net gets Patriot up

continued from page 1

schedule. The first Patriot to knock out an incoming Scud missile — on Jan. 17, 1990, over Dahran, Saudi Arabia — was made just two months earlier.

For building the redesigned Patriot missile in time to be used in the Gulf War, a paperless manufacturing system deployed in the MSD plant here gets some of the credit from the defense contractor and electronics company.

"Our paperless system, as well as our advanced [Materials Resource Planning] systems, enabled us to hit the floor running to meet wartime production needs," said Peter Galligani, plant manager at MSD.

The system, based on IBM hardware and software, helped MSD maintain product quality while doubling production output and training 300 new workers to staff the plant three shifts a day. It enabled MSD to eliminate more than 2.5 million pieces of paper from assembly areas, speed the introduction of engineering changes from days to hours and automatically convert computer-generated part designs into assembly instructions for operators on the plant floor.

By improving the accuracy and clarity of the work instructions used by assembly operators, the system has boosted product quality, minimized rework and scrap, and simplified training of new workers.

Top this, Saddam

MSD introduced the paperless system in 1988, putting about 200 IBM graphics terminals on workers' desks. Today, MSD has installed more than 700 terminals in six major assembly areas throughout the plant.

The terminals display step-by-step instructions and color diagrams showing operators exactly how to assemble a part. Previously, operators were given paper-based instructions.

The operators' terminals are linked to an IBM 3081 mainframe via an IBM 3174 cluster controller connected to an IBM Token-Ring Network. The Token-Ring supports a number of Personal System/2 workstations used by industrial engineers to develop assembly instructions and by technical illustrators to draw instructional diagrams.

The host-based IBM IMS data base management system contains the work instructions for more than 5,000 parts manufactured at the plant.

With electronic instructions, each step of the work procedure is described in text and portrayed in a color-coded diagram. The diagrams highlight in yellow the parts an operator must add to complete the step.

The paper instructions typically had one black-and-white diagram for every four or five steps, making it difficult for the operators to visualize what the part looked like after each step of the process, said Peter Teague, manager of plant administration.

The electronic system ensures that every operator is working from the same clear instructions. While it is difficult to quantify, Teague said the paperless system has helped MSD decrease the amount of rework and scrap at the plant in recent years.

The paperless system also makes it easier to introduce engineering design changes and keep track of what version is being manufactured in each part of the plant. Previously, any engineering change required changing the paper sheets, which was time-consuming and error-prone. It was difficult to ensure that all the old work sheets had been collected and new ones distributed.

Now all changes are submitted electronically to a configuration control manager, who verifies the changes and updates files on the host.

Since 1988, all designs have been created or updated on the PS/2 workstations and then uploaded to the host. Designs created before 1988 on paper have been scanned into the system and modified as needed by technical illustrators.

Automated engineering

In the case of printed circuit boards, which MSD produces in high volumes, staff engineers wrote software that automated the process of developing work instructions from original computer-aided design files.

The software resides on a Sun Microsystems, Inc. workstation on an Ethernet supporting Sun workstations used by engineers.

The software downloads CAD files from a ComputerVision, Inc. Product Data Manager database on a mainframe in Bedford, Mass., across Raytheon's wide-area network. It then converts the CAD files into step-by-step work instruction sheets and changes them from ComputerVision's proprietary format to the Initial Graphics Exchange Specification (IGES) format.

The files are then sent, via a Transmission Control Protocol/Internet Protocol gateway, to the IBM host that maintains work sheets. The host converts the IGES files into IBM's graphical format so that the work instructions can be displayed on the plant floor terminals.

Automating development of work instructions lets MSD's engineers spend more time on other engineering activities, said Robert Ferrara, manager of information systems at MSD. "We can draw up a complete set of instructions from a CAD file without human intervention," he said. "We don't know of any company that has achieved that degree of integration or automation."

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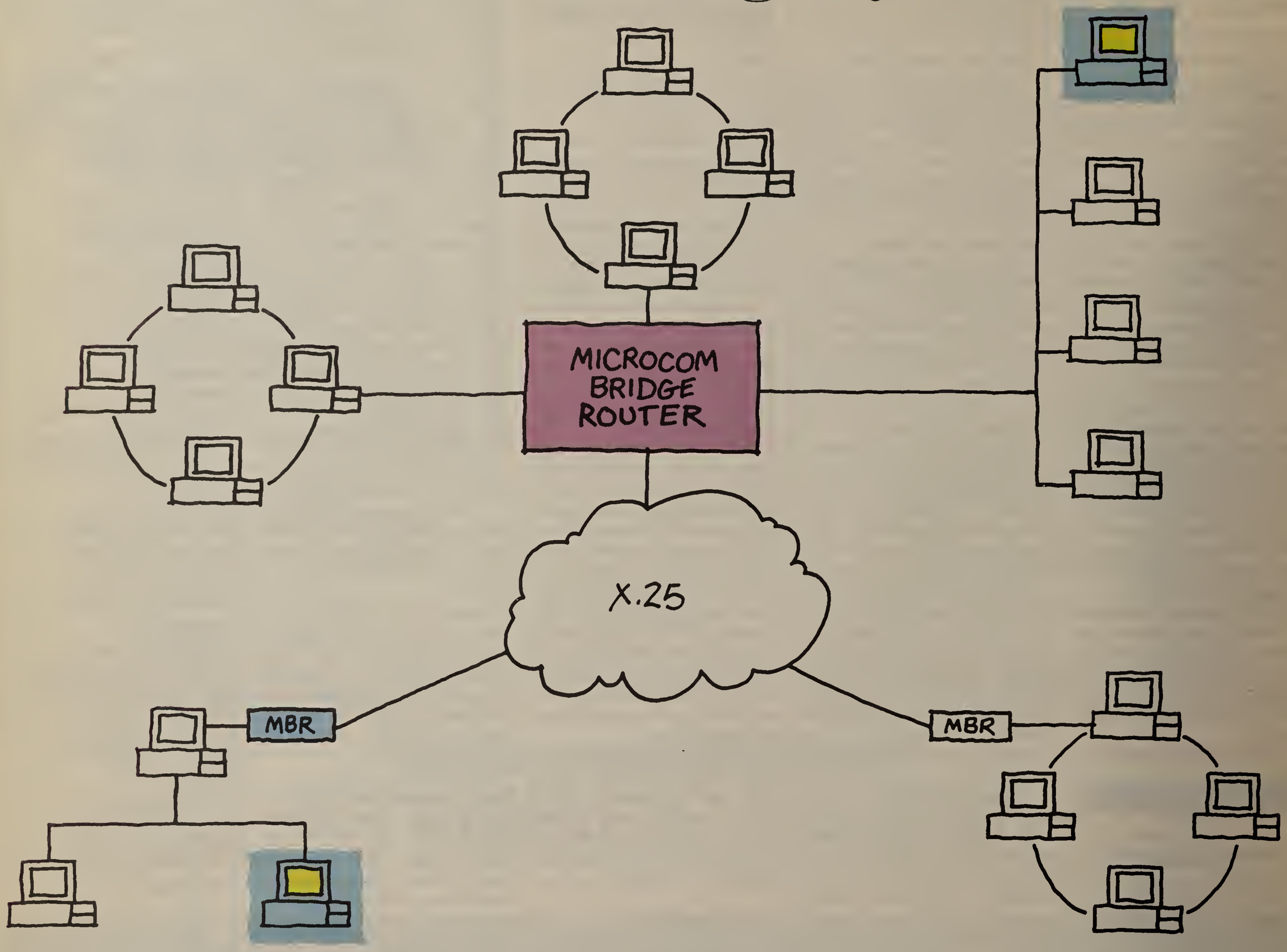

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